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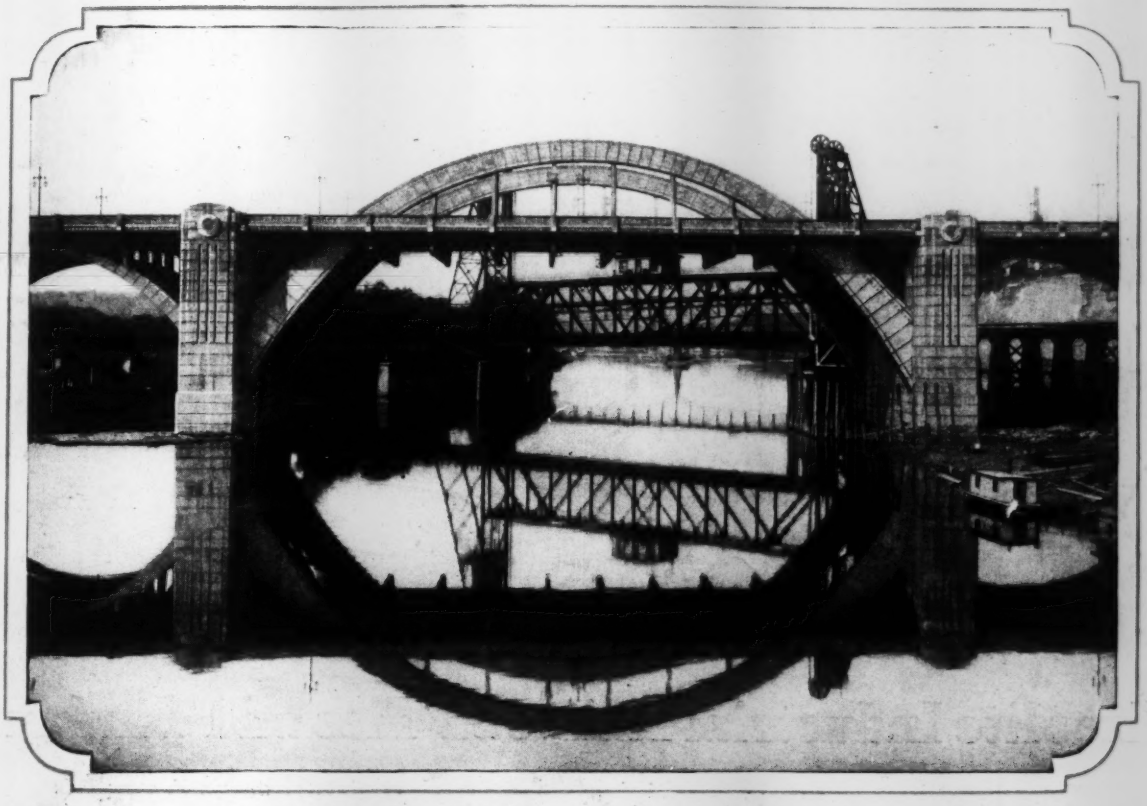

Robert Street Bridge Across the Mississippi at St. Paul

Engineering and Architectural Design of a Long Concrete Bridge
By W. E. King and Roy Childs Jones

Structures on a Texas Water Service District
By J. L. Lochridge

Straightening the Chicago River Involves Many Problems

Concrete Drydock Completed in Twelve Months

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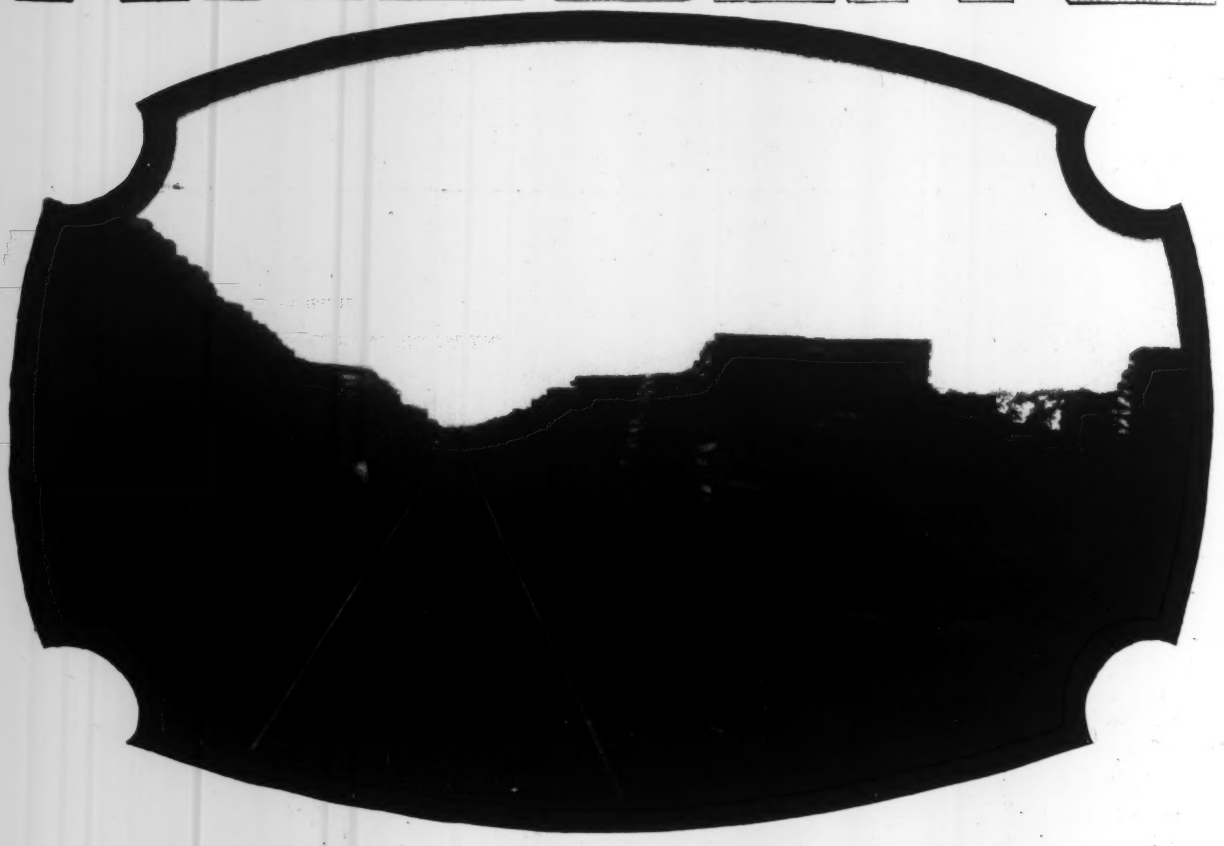

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FRANK C. WIGHT
Editor

Volume 97 NEW YORK, NOVEMBER 4, 1926 Number 19

Men Not Policies

EVERY four years the American citizen gets a chance to express himself at the polls in matters of national policy. In between election day more often than not merely gives him an opportunity to vote for or against a man. Occasionally there arises a man so great that in himself he personifies a policy but such men are rare. Certainly none of those who sought preference this week are of that type. Matters of economic importance were submerged in personalities, with few exceptions. So the election of Tuesday may mean something nationally or it may not, just as your own politics leads you to wish. At this writing, however, a good many of the administration supporters seem to have gone down to defeat. There was, we believe, in ancient Greece a violent reaction against a certain beneficent leader because the people got tired of hearing him called "The Just." Human nature has remarkably persistent qualities.

The Price of Progress

PROGRESS is a hard taskmaster. Energy and thought and application are required by the individual or business or industry that would forge ahead of competitors, but the price of progress so gained is an obligation to greater progress. Once the one who works to open new fields or discover new processes achieves success close on his heels come the less resourceful, imitating and adapting, utilizing the knowledge they themselves were too lazy or unintelligent to seek. This is the text of a little sermon that G. M Verity, the president of the American Rolling Mill Co., preached to a group of associates at Middletown last week. It is a good text for all to remember. Pioneering is often disappointing; others come so soon to reap the rewards. But the pioneer is the one who is out in front and he knows as the follower can never know how difficult was the way there. He is hardened to the adventure and the way ahead becomes that much the easier. Kipling's Sir Anthony Gloster summed it up—"They copied all they could follow, but they couldn't copy my mind, and I left 'em sweating and stealing a year and a half behind."

Special Motor Roads

ITALY'S construction of autostrada or special motor vehicle roads, generally toll roads, is the activity which in recent years has most attracted the attention of engineers to the road building of that country. As Italian practice defines it, the autostrada is a paved road on a separate right of way fenced in and guarded at entrances, without intersections and crossings at grade, designed and reserved for motor vehicle—truck or automobile—traffic solely. It is a fast, or express, traffic road designed and built for uninterrupted speed. Emphatically it is an independent road, separate and distinct from the existing highways between the same termini. Voluminous conclusions broadly in favor of such roads were adopted recently at the International Road Congress at Milan, with, however, the delegates from Great Britain and the United States declining to vote on the basis that experience and service records are lacking for "definite conclusions capable of general application." The conclusions are most interesting, perhaps, for the indication which they furnish of the liberal views which European highway authorities express regarding the financing of special roads. It is held that they may be financed from the state's general balance, by a general motor tax, by special taxes (tolls) on users, by local bonds or subsidies or by any combination of these which may be for the public weal. Tariffs or tolls it is considered should be regulated by public authority. In regard to the justice and expediency of the toll road principle the conclusion is that "it is quite fair and rational that a special tax should be levied upon those who willingly make use of a speedier and more convenient means of transport over certain distances, while they are still free as any other motorist, to choose between the autostrada and the ordinary road." As the problem of the high-speed trunk road, perhaps the toll road, is directly before us in America these conclusions of European engineers are of particular interest.

Moving a River

STRAIGHTENING the river has been a goal of Chicago aspirations since the early years following the Columbian Exposition when the Chicago Plan idea began to materialize into actual performance. It is now about to be begun. The arrangements and the general plan are outlined in this issue. True no great length of river is to be rectified nor is this essentially desirable but the obnoxious bend in the South Branch between Roosevelt Road (old 12th St.) and 18th St., is to be eliminated and the irregular plats of land east and west of the river largely occupied by railway yards, turned into shapely rectangular areas giving freedom for new railway terminal arrangements which it is announced the railways are already planning for to the amount of millions. Few city public works improvements of recent years offer greater opportunities for city development than does the river straightening now to be undertaken by Chicago. Its advantages to the railways may in a measure be estimated by the fact that they have been willing to pay a bonus of over three million dollars for the allocation of land which they will secure leaving the taxpayers of Chicago to provide less than two millions for the physical construc-

tion. As engineering construction counts now-a-days, there are no great difficulties in the physical task of river alteration—a steam-shovel excavation and fill, two moderately expensive bridges, a little sewer and water pipe trenching and laying and less than a million and a half dollars in buildings and track relocation. The outstanding task has been performed in securing the agreement for the improvement between many and diverse interests all either indifferent to or suspicious of the effort.

Mysterious Unionism

PART of the resentment that many people have against the labor union is due to the veil of mystery that is thrown around its operations. Theoretically the labor union is a public good; it purports to raise the standards of labor and labor comprises a good share of our population. Anything that benefits labor should benefit the community, provided always that this benefit is not at the expense of the community. Nevertheless the union, either through necessity or desire, has a tradition that it is conducting a war, not against the community of course, but against the employer and it follows the first principle of warfare that it must not reveal its plan nor detail of campaign. Consequently its entire operations are shrouded in secrecy and its policy the characteristic policy of the revolutionary—tell the world nothing of what you are doing. A typical exhibition of this policy was made last summer by the president of the New York Building Trades Council before a legislative committee attempting to get some facts on building conditions in New York City. In his testimony, just now made public in full, Mr. Halkett is a studiously unresponsive witness. He, the leader of the building trade unions in our largest city, does not, or says he does not, even know how a strike is called; he knows nothing of any strikes that have been called; he has no opinions on the efficiency of bricklayers. In short Mr. Halkett gave a fine example of what we should imagine would be the attitude of the head of the Tomsk soviet were he by chance called before the League of Nations to tell how his organization functioned. This unresponsiveness, this mystery as to how the labor union works, does more to make the average man distrust it than all of the partisan accusations that come from the manufacturers' associations. Time was, possibly, when trades unions had to conduct themselves as though the public were their enemy. That time has passed and if they choose to act as though it were here they will only hasten its return.

Highway Traffic Engineers

IN the traffic signal field at present two phases stand out—the gullibility of many city officials who purchase wrongly from fast talking salesmen and the lack of enough capable highway traffic specialists to whom these city officials can turn for unprejudiced and sound advice. It is true that in a number of the larger cities engineers have attacked the problem in an excellent manner and several first-class systems of traffic control are the result. The men responsible for these systems are highway traffic engineers in the highest sense of the word. But so far as most of the smaller cities are concerned there is no such person as a highway traffic engineer. As a result it has become incumbent upon the traffic signal manufacturer to supply, in addition to his signal equipment, recommendations as to signal location, type of signal to be used, plan of operation and similar requirements. This means a comprehensive study of practically every major street intersection in the city and a correlation of results based upon a thorough knowledge of available systems. Some few of the signal manufacturers have accepted these responsibilities and by including in their personnel several most capable highway traffic experts are able to furnish a city a properly designed traffic control system. On the other hand far too many manufacturers merely are selling carloads of signals rather than a workable and efficient installation for highway traffic control. Such manufacturers must realize that sales predicated only upon the desire to sell as many and as expensive signals as possible without including the consulting service that the city officials need are nursing a very unhealthy condition in the industry. But even should all of the manufacturers accept their responsibilities to sell highway signals plus expert advice can they keep up with the demands from practically every city in the country for an efficient and reasonably priced traffic control system? It hardly seems likely. As a remedy another important division of the civil engineering profession might well be fostered and developed. We need more consulting highway traffic engineers.

Construction Progress Charts

THE ramifications of a modern construction project are such that even with a well-trained organization it is difficult to co-ordinate all the various operations, involving as they do widely different classes of material and methods. Where speed is essential, particularly where completion by a certain date is a part of the contract, there is great advantage in planning each operation with respect to the time required for it and its relation to other parts of the work. This is where progress charts or time schedules can be used to good advantage. They really perform a twofold function in that (1) the preliminary study is likely to be more thorough and therefore more reliable if the actual time of each operation must be estimated and plotted and (2) when delay occurs on a job where progress charts are featured the location of trouble responsible for slowing up the work is at once apparent, thus aiding in getting attention concentrated on that point. To make the most of the plan the entire program should be laid out on a single sheet so that the relation of all operations is apparent at a glance. Usually the various items, perhaps beginning with excavation and ending with painting, are listed in a vertical column as nearly as possible in their logical sequence; time can then be plotted horizontally. With this arrangement it is convenient to show both the estimated and the actual time of beginning and completing each operation and at any stage of the work the status of the job as a whole may be grasped at a glance. A progress chart is of no value unless based on experience with the practical problems involved but where an experienced contractor undertakes a rush job it is well worth his while to give careful consideration to progress charts for they can be made important factors in maintaining high speed on the job.

More Effective Wind Study

WITH the earliest reports of storm destruction in southern Florida last month it was again evident, as it had been in prior storms, that weather reports relating to wind are seriously at fault. A velocity of 80 to 85 miles per hour was reported from Miami. Despatches from some other points gave figures ranging up to 120 or 130 miles per hour. A number of important wind observing stations had their instruments blown away and so gave no records. Tremendous damage and destruction occurred, clearly caused by a storm of almost unprecedented intensity, one that might well set a standard for the design of buildings and engineering structures in similar storm-exposed regions, in order to give protection against future storm devastation; but the official wind reports were bare of all data by which such future design might be guided.

It has been the case quite generally in meteorological reports of storms that figures from which the engineer could measure the storm action, compare with other storms, or proceed to quantitative design of future structures, were absent; only a few vague and discordant wind velocities were reported. The later and fuller reports of the Florida storm strengthened the reasons for engineering dissatisfaction with wind reports. The practical value of such reports for engineering purposes appears in fact to be negligible.

A graphic criticism of the chief weakness of wind reports was voiced at last week's convention of the American Institute of Steel Construction, where several speakers independently made the demand that wind intensity be reported in pounds and not in miles—in pressure rather than in velocity. This demand invites hearty agreement and a hope for speedy reform of practice, though it bears on only one of the points in which the wind meteorologist has failed the engineer.

It will be obvious that the safety of a structure against wind does not depend on the velocity, but upon the pressure which wind exerts on the structure. Wind velocity and pressure are supposed to be related by a mathematical formula, and a great deal of study has been given to this formula as applied to different air speeds and forms of exposed surface. But the relationship is academic, essentially a laboratory matter, applying to steady, smooth wind currents flowing calmly against a test surface. Wind in the open is not like this. It is turbulent; it rises and falls, tears around in gusts which veer from point to point and deliver repeated blows, and may carry water to add to its force. But even if some typical average relation can be established between momentary wind velocity and the resultant pressure, how can this be applied to average five-minute velocities—in a few cases one-minute velocities—as read from anemometer records? Such records give no indication of variability or momentary effect, and even though the variable character of the wind is obvious to the observer the records give no clue to the degree of variation. In effect they transform the wild, erratic wind of reality into a sanely equalized stream that may, conceivably, be comparable with the test current in a laboratory wind tunnel, but is by no means real wind.

Wind gusts or pulsations are apt to be of special importance in severe storms, with respect to certain kinds of structures at least. This was briefly discussed in our pages a few weeks ago (Oct. 7, p. 567), in view of certain structural effects in the Miami region that otherwise appeared contradictory. Yet this very characteristic of gustiness leaves no trace on the anemometer records and indeed appears to be quite ignored by the meteorologist, to the extent that the periods and peak values of wind gusts remain quite unknown.

Even this is not all of the situation. Wind velocities as regularly reported by the weather bureau are in fact not wind velocities at all, but differ from them in a large and variable ratio. The figures reported as wind velocities are nothing more than anemometer speeds, obtained by an instrument known to be grossly faulty. In high winds the anemometer speeds are considerably larger than the air speeds; for example, an anemometer speed of 100 miles per hour represents a real wind velocity about 25 per cent less, and higher speeds show still larger discrepancies. Yet the published weather reports do not give the corrected wind velocities, but contain only the anemometer figures, in spite of their well known errors.

In the Florida storm a further factor of trouble appeared: At the most exposed points, where the most valuable information on wind might have been obtained, the instruments blew away during the storm. The weather bureau gage in Miami, in a sheltered location, useless for giving true wind indications, remained in place, but instruments elsewhere, such as one at Pensacola, and one at Miami Beach whose fragmentary record is reproduced in this issue, failed at the critical time. Messrs. McConnell and Hammond report the same failure at Havana. Anemometers as used by meteorologists appear to be frail devices, incapable of weathering extreme storm winds. At the very moment when the world's practical interest in the readings of the instrument becomes greatest—at velocities reaching 100 to 120 miles per hour—the instrument fails.

Storm damage mounting into the millions represents a challenge to mankind. Our best efforts are evoked to prevent and forestall future repetition of such destruction. Primarily the task is put to the engineer, but for his data on wind he looks to the appointed student of the subject, the meterologist who is equipped with vane and gage to record storm wind habits and manifestations. In the present juncture this reliance has failed, and whatever is to be learned from the Florida or Cuban storms for the benefit of future construction and for increased safety of life and property will have to be deduced by the engineer himself, without aid from the weather student. The rough calculations that he can make from his structures will have to tell him what the scientific measurements of the meteorologist failed to give.

It is a justified demand, then, when engineers ask that wind be measured and reported in pounds rather than in miles. And it is proper to add the further demand that the records shall give maximum rather than average effects, that they be taken in sites of representative exposure, and that they supply quantitative information on the variation and periodicity of winds. If these demands necessitate a complete re-planning of the wind observer's instrumental equipment, it will be well if the work is taken in hand without delay. Or, in case these demands cannot be met and the meteorologist with his delicate instruments must confine himself to the study of light breezes, it will fall to the engineer to take up wind study for himself and investigate wind habits and pressures as needed for safe construction.

Engineering and Architectural Design of a Long Concrete Bridge

Robert St. Bridge at St. Paul Has 264-Ft. Two-Rib Arch Channel Span Flanked by Five-Rib and Barrel Arch Spans—Structural Steel in Main Spans

By W. E. King and Roy Childs Jones
Of Toltz, King & Day, Inc., Engineers and Architects, St. Paul, Minn.

A CONSPICUOUS structure at St. Paul, Minn., is the new Robert St. bridge across the Mississippi River, which was opened for traffic Aug. 6, 1926. It is a reinforced-concrete arch structure replacing a steel bridge built in 1881, the replacement being made to secure a wider roadway. As the old bridge had a minimum width of 32 ft. between curbs, with two sidewalks 8½ ft. wide, congestion resulted largely because vehicles could not pass the street cars. The new bridge has a 56-ft. clear roadway with two 10-ft. sidewalks, the bridge being made the full width of the street. Interest in this bridge centers in the reasons for the adoption of the parts which make up the whole, and in the architectural treatment. The construction methods will be dealt with in a separate article.

* * *

Engineering Features of the Bridge

By W. E. King

ANY study of the engineering features of this bridge must take into consideration the very congested local conditions, the location of nearly every pier being predetermined by the clearances required by existing structures and railroad property. From the general elevation, Fig. 2, it will be noted that the bridge crosses successively over Second St., the freight shed and tracks of the C., St. P., M. & O. Ry., the tracks of the St. Paul Union Depot, which handles the entire passenger traffic of the city, the main line of the Chicago Great Western R.R., and the river channel of the Mississippi as defined by the War Department, the south end of the bridge then terminating in a busy manufacturing district. The elevation of the roadway was determined by the grade of Robert St. at the two ends of the bridge and by the limitation that the grade on the bridge proper must not exceed 3.1 per cent, which was the grade of the old bridge. These conditions, combined with the clearances required by the railroads and the government clearance of 47 ft. above ordinary high water, practically determined the location of the roadway.

The total length of the bridge including approaches is approximately 1,900 ft. Starting at the north end, there are a reinforced-concrete trestle with three spans of varying length totaling 89 ft.; a skew steel deck-girder span of about 53 ft. across Second St.; three flat barrel arches with a combined length of about 291 ft. followed by a two-rib arch span of 264 ft., c. to c. of piers, and four five-rib arch spans totaling 514 ft.; then a 311-ft. concrete trestle on concrete piles, with eight spans; and finally 260 ft. of earth fill between buildings and concrete retaining walls.

Foundation conditions were determined by borings made during the winter of 1923, some twenty holes being driven about 10 ft. into a fairly level layer of Shakopee limestone found at El. —81 or about 66 ft. below the river bottom. The material above the limestone consists of indiscriminate layers of gravel, coarse sand and fine sand, with occasional layers of clay and pockets of fine sand (possibly quicksand). On the north shore is encountered a layer of sandstone overlain with "tumble rock" from the cliffs above and cemented together with clay into a hardpan.

Foundations and Piers—Two types of foundations were considered: Piles and a caisson type which would extend the concrete foundations to the limestone ledge. The latter would have provided the unyielding foundation so necessary for an arch bridge, but the expense would have been much greater than for the wood-pile design which was adopted. In order to secure rigidity, the piles were jetted and driven to a practical refusal. In every case they were driven below any possible river scour and were cut off at or below low-water line. At the north end, where piledriving was impossible, the foundations were set upon hardpan. For the trestle and retaining wall at the south end of the bridge, where there is no danger of scour, short concrete piles were cast in place, with cores driven to refusal. These foundations were stopped at El. +6, the only consideration being that they would extend below frost line.

One of the interesting problems lay in the location of piers 1, 2, 3 and 4. It will be noted that the government river channel, 160 ft. wide, passes under the bridge at a skew to the south. The location of this channel is determined by that of the lift span of the Chicago Great Western R.R. This line crosses under the bridge on a skew to the north and it was necessary to locate a pier in the angle between these clearances if an arch span was to be used.

Pier 2 had to be no wider above ground than the pier of the old steel bridge. Pier 1 likewise was limited as to width by the clearance lines of existing railroad tracks. A glance at the design of these piers, Fig. 3, will show that they are much more slender than would ordinarily be used, and are in fact vertical reinforced-concrete cantilever extensions of the wide footings below ground. South of pier 4 there were no limitations as to pier locations, so that span length was determined by economic considerations, taking into consideration also the architectural appearance of the bridge as a whole.

Each pier footing consists of a heavily reinforced concrete mattress resting on piles spaced 30 in. c. to c. in each direction. Above this, the piers are of mass concrete, reinforced for temperature stresses and for eccentric loading. Where piers are extended for architectural treatment, the concrete has been cored out for economy, the exterior walls being approximately 2 ft. thick. Above the haunches of the arches the piers are hollow and are utilized for manholes for the public utilities.

Through-Arch Span—The main point of interest is the 264-ft. through-arch span, 244 ft. in the clear between piers. This design was necessary because of the government requirements of 62-ft. headroom above low-water for a skewed channel width of 160 ft. or 180 ft. along the bridge. With the roadway elevation as fixed, a through span was necessary if an arch span was to be used. This through-arch span is shown in Fig. 4.

Since the station of the north springing line was fixed, as was also the point where the intrados passed the clearance line of the channel, the variations open to the designer in trying to adapt the neutral axis to the dead-load equilibrium polygon were restricted. While for the final design a curve was found to give a line of resistance which remained within the middle third, the deviations of the polygon from the neutral axis were a maximum at the crown and at the quarter points. Instead of the usual compound curves resembling a basket handle, with the long radius at the crown and the shorter radii at the haunches, the radius is 122.16 ft. at the crown and 191.60 ft. at the haunch.

The two main ribs, each 6 ft. wide and 8 ft. deep at the crown, were spaced 64 ft. 8 in. c. to c., so as to clear the roadway 8 in. at each curb. The sidewalks were then detoured outside of the ribs in a way which adds to the architectural interest of the roadway. This is shown in Fig. 5. Considerable thought was given to the lateral support of these arch ribs and also to the expansion and contraction relative to the roadway.

A structural steel frame is used for each arch rib, as shown in Figs. 4 and 7. The steel arches are designed to be erected either as cantilevers supported from temporary towers or on falsework. They are designed to carry the weight of the steel structure, including the steel floor system, and also the dead-load of the concrete arch proper. The dead-load of the concrete roadway and the live-loads are carried by the composite concrete and structural steel arch.

The heavy box section of the top and bottom chords of the steel arch permitted the building in of the steel posts and hangers between the two side members of the chords in such a way as to give lateral support to the arch rib from the floor girders. The arch ribs have heavy steel cross bracing below the roadway. These steel arches were erected on timber falsework, the crown closing sections being drilled in the field. Steel floor girders 22 ft. apart were used to give a maximum clearance over the river channel. The use of structural steel hangers provided a simple method of delivering and distributing the floor girder reactions to the arch ribs. A covering of gunite on wire mesh was applied to the girders and bracing in order to protect the steel with a minimum of dead weight.

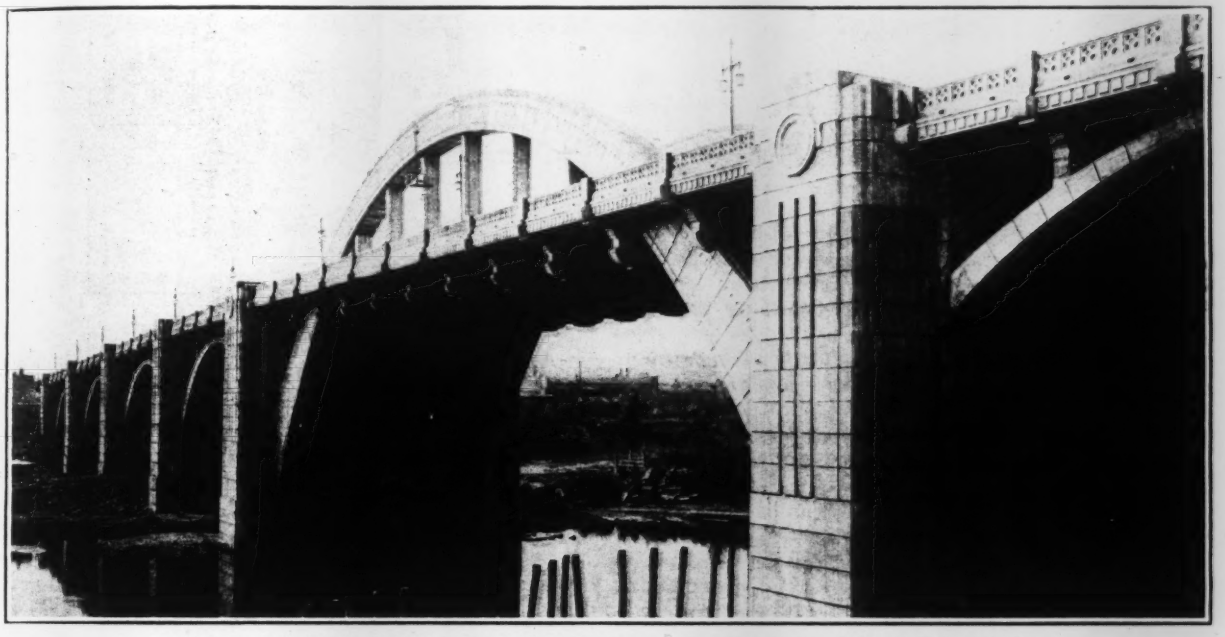


FIG. 1—LOOKING ALONG THE COMPLETED ROBERT ST. BRIDGE, ST. PAUL, MINN.

Special care was used in pouring the sections of the arch ribs so as to transfer the load to the concrete without disrupting the bond between the concrete and the structural steel. The concrete was poured in sections so as to equalize the load on the arch, with provisions for keys between the sections.

Barrel and Ribbed Arches—The design of the three barrel arches has no special interest except in the application of an arch design to very trying conditions. Thus, arch 2, a 70-ft. span, crosses the four main tracks leading west from the union depot, which tracks carry traffic for nine railway systems. With the center of the north track at the minimum allowable distance of 8 ft. from the south face of pier 1, clearances for the intrados of arch 2 were figured as closely as for the portal of a through steel truss span.

Clearances for the intrados of arch 3 were determined from the requirements of the main line of the Chicago Great Western R.R. which runs under the arch at an angle of 55 deg. with the center line of the bridge. This arch is a 98-ft. span with the springing line 50 ft. above low water and 35 ft. above the springing line of arch 4. Arch 1 is a skew arch, 96 ft. long at the center line, with its springing line 6 ft. below that of arch 2 and

1 ft. below that of arch 3. The three arches are designed to make up a unit, with the north abutment and pier 3 acting as its abutments.

In piers 1 and 2 the shafts have been designed to resist the moments resulting from the excess of the thrusts of the longer spans 1 and 3 over arch 2. The thickness of the piers below track clearance lines was increased from 8 ft. to 14 ft. and the footings, 32 ft. wide with piles spaced 30 in. c. to c., were offset 24 in. from the center line of the pier. The moment of the thrust of barrel arch 3, with its springing line high above that of the ribbed through arch, exceeded that of the latter. The footing, 42 ft. in width, was offset 18 in. from the center line of the pier to reduce the maximum load on the piles along the south face of the footing.

The five-rib arches, 5, 6, 7 and 8, are 112-ft. clear spans set at varying heights to accommodate the slope of the roadway. They are designed and located to neutralize the thrust of the through arch at pier 4. One of these spans is shown in Fig. 6.

Girder Spans—The steel span of the north approach crossing Second St. consists of twelve 48-in. plate girders, 46 ft. long, protected with gunite. Steel girders were necessary to give the required headroom for trucks. The 33-ft. concrete girders forming the eight spans of the south approach were flanked on both sides by shops of the American Hoist & Derrick Co. Much of the area under this portion of the bridge has been bricked in to be used for shop purposes, the girder and beam type of span being well adapted for this use.

Expansion Joints—The provision for expansion and contraction, together with the waterproofing of such joints, is regarded by the designers as one of the very important things to be provided for. An inspection of a large number of concrete bridges showed that in nearly every case failure or deterioration was taking place at the expansion joints. Wherever concrete was arranged to slide on concrete the joints usually failed by the failure of the concrete to slide and thus cracking elsewhere. Many joints failed because of water being trapped and freezing. Some joints filled with dirt which, caked with bitumen, appeared to be nearly as hard and inelastic as the concrete itself. In general, no satisfactory joint was found and the joint used on the Robert St. bridge, Fig. 3, while having some advantages, is regarded only as a step in the right direction.

The location of expansion joints is shown in Fig. 2. In general there are no sliding surfaces. The joints are placed at frequent intervals and any movement is taken up by bending in the supporting columns. This results, as a rule, in a double set of supporting columns. These columns (or one column and the adjacent pier) are separated by a 1-in. layer of elastite. The expansion joints extend completely through the roadway, sidewalks and railings in every case.

For waterproofing the roadway joints a crimped lead plate of special composition was placed across the joint, the ends being brazed together to make a tight joint across the roadway. This plate is held in place by the bolts which extend through the anchors in the concrete below and also the 3x3-in. angle above. It extends back into the fabric waterproofing so as to make a tight job. The steel angle is used as a stop for the brick paving, which rests on a ¾-in. sand cushion, the joint in the paving being closed with asphalt. The concrete deck slab was waterproofed with three layers

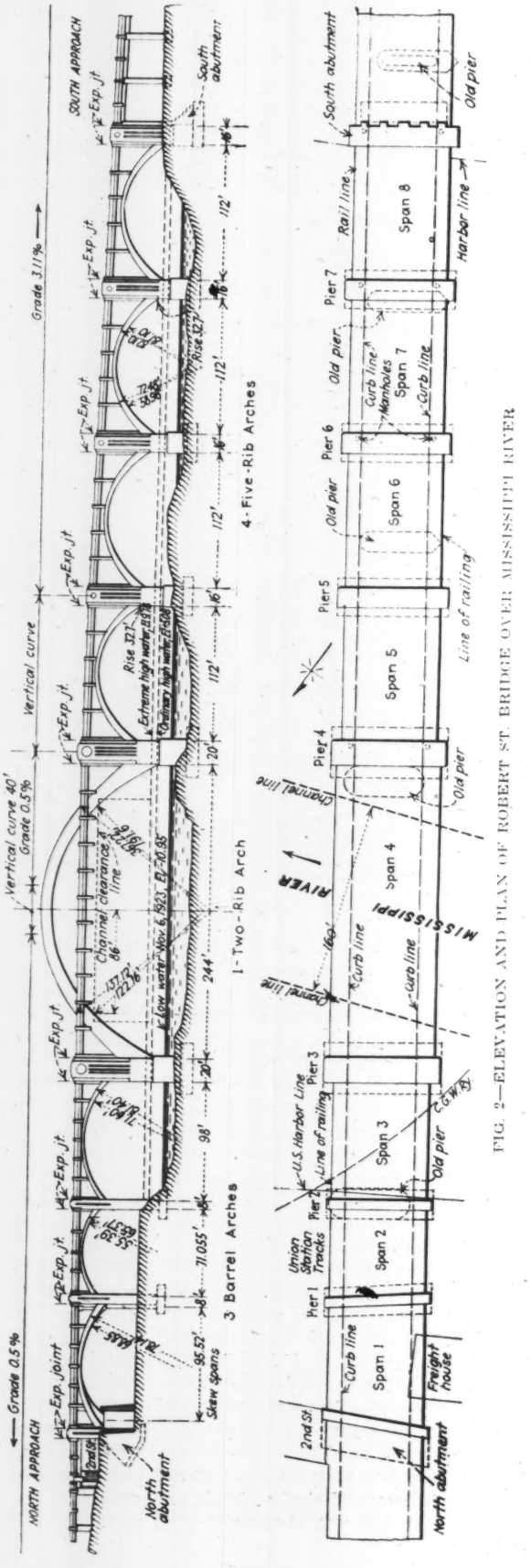


FIG. 2—ELEVATION AND PLAN OF ROBERT ST. BRIDGE OVER MISSISSIPPI RIVER

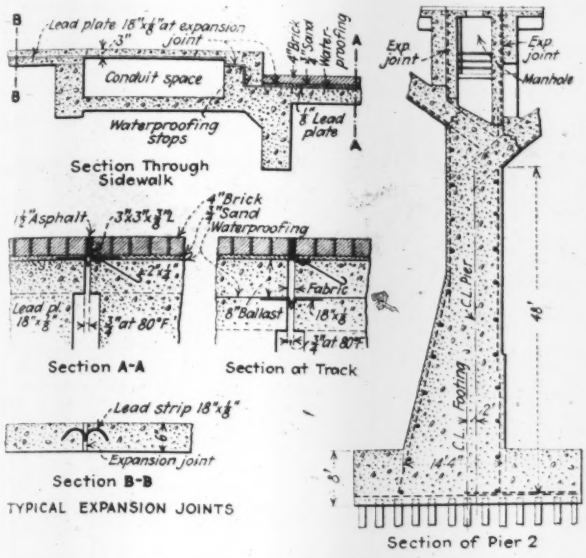


FIG. 3—EXPANSION JOINTS AND PIER SECTION

of cotton fabric impregnated with asphalt and laid with four coats of asphalt.

Paving and Conduits—A 4-in. brick pavement on ¾-in. sand cushion provided the wearing surface of the roadway, except that granite blocks were used between the car tracks. This paving was laid to a 5-in. crown, with 10-in. curbs protected by a steel angle. The tracks, with steel ties, were placed by the street car company and concreted in place in the trough provided in the deck. Electric conduits of two power companies and the telephone and telegraph companies were provided for in two troughs under the sidewalks, suitable manholes being provided at the piers. Space for two gas mains was also provided.

Lighting—With a series system arranged in two circuits, lighting intensities on the roadway will vary from 1 to 2 foot-candles with the minimum of glare. An attempt has been made to harmonize the appearance of the combination light and trolley poles with the remainder of the bridge, as shown in Fig. 8. Standard tubular steel trolley poles spaced approximately 125 ft. apart have double pendant lantern units suspended from special cast-iron brackets at 17 ft. above the roadway. Simple base castings and brackets are the only decorations applied to these poles.

Each lighting unit consists of a 400-cp. lamp enclosed in a lantern with rippled glass sides and top equipped with prismatic dome refractor designed to throw the light on the roadway. Lamps are operated upon a 6.6-ampere primary circuit with transformers at the base of each pole.

* * *

Architectural Features

By Roy Childs Jones

THE Robert St. bridge is unique in that its designers included in their own permanent organization both architects and engineers. This fact made it possible to take full account of the mingled utilitarian and esthetic problems present in a structure destined to serve as a civic monument. Instead of architects being called in to beautify with applied ornament a predetermined structure, architects and engineers combined during the initial stages of the design in an effort to select and

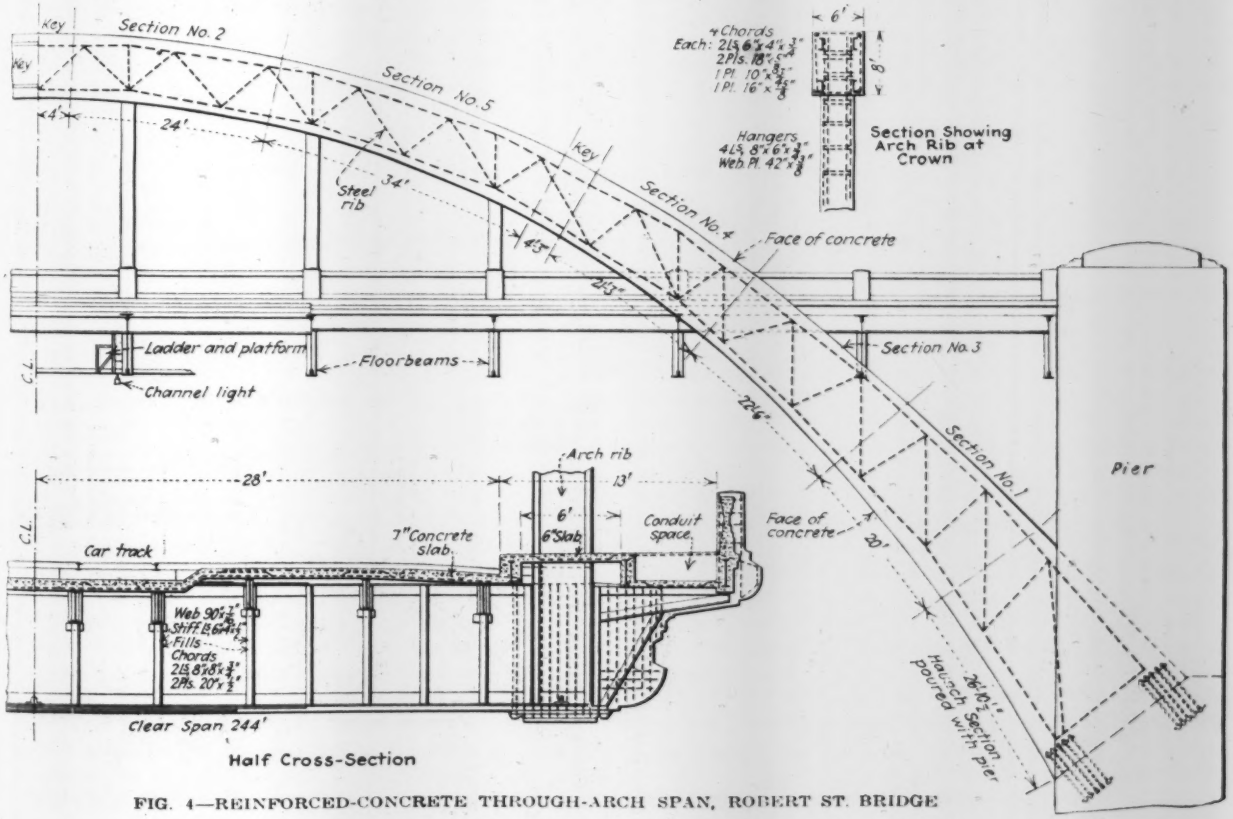


FIG. 4—REINFORCED-CONCRETE THROUGH-ARCH SPAN, ROBERT ST. BRIDGE

FIG. 5—DECK OF THROUGH-ARCH SPAN OF ROBERT ST. BRIDGE

control the structural features so as to secure for the bridge an inherent beauty of form and proportion.

With the complicated requirements of street grades and of railroad and channel clearances, any simple and regular composition of arches and piers was out of the question. The first effort was to minimize this difficulty by throwing all possible emphasis on the center span, and subordinating the approach spans with their discordantly varying shapes. To carry out this intention, the approach spans were made as short as possible, and their piers were kept comparatively simple.

From this point the architectural treatment of the bridge became a matter of so managing the detail as to express to the eye the actual qualities of strength and utility put into it by the engineer. Generally speaking, this was accomplished, not by adding ornament, but by controlling the shapes and proportions and relations of the structural members. Fortunately there is an inherent beauty in the mathematically determined curve of an arch that only needs letting alone to be apparent. In this case nothing was done to the arches except to emphasize their size and spring by certain lines of shadow, and by seeing to it that the curves swept unobstructedly and dominatingly from haunch to crown.

Treatment of the piers and deck was more difficult, but the scheme arrived at had several important features. There was a perfectly frank expression of the actual structure of the deck beams and supports, without resort to screens of false arches. Great care was

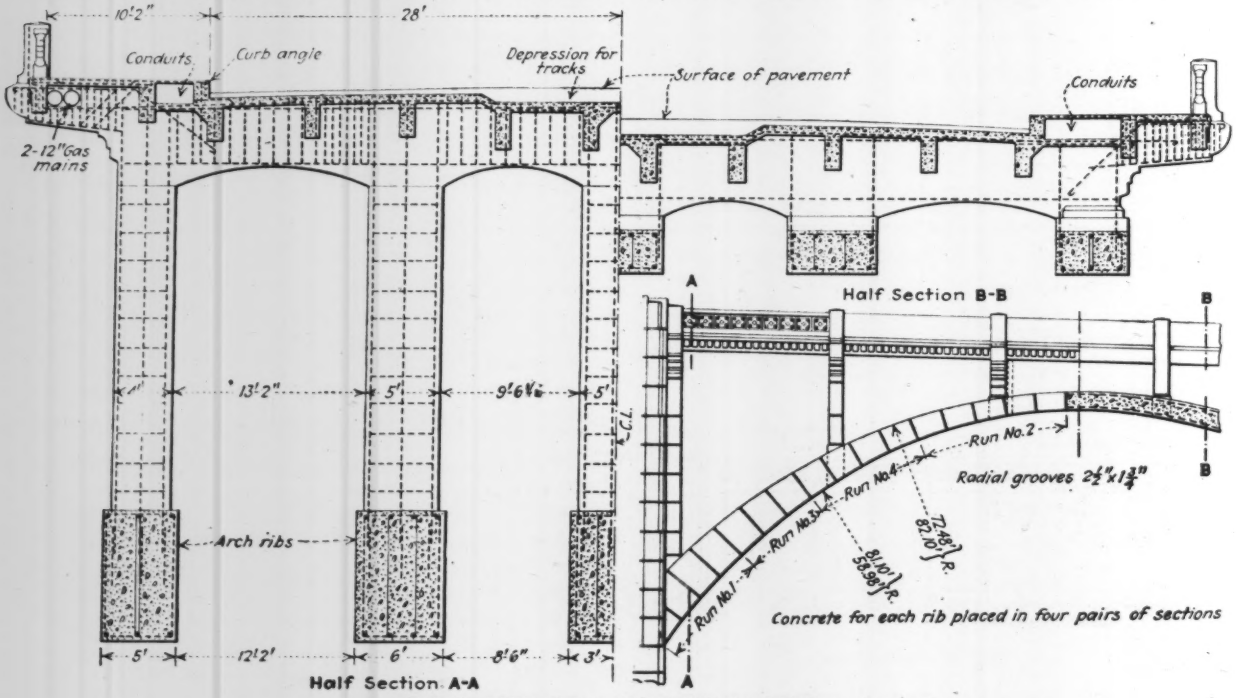


FIG. 6—FIVE-RIB ARCH OF 112-FT. SPAN

taken to preserve the continuity of the actual line of the deck and to emphasize and enrich it by appropriate sectioning.

Hand-Railing—As a part of the deck treatment, the rail naturally came in for a large share of attention, since the appearance of a bridge from the point of view of the people who use it is almost entirely a matter of the rail. Furthermore, it is seen from close up, and must have a refinement of scale and a degree of finish not easy to obtain in concrete. In addition, it must not only have great rigidity to resist the possible impact of heavy modern trucks, but sufficient flexibility to expand and contract without unsightly cracks.

The problem was met here by a scheme of precast perforated panels anchored between poured, heavily reinforced members at top and bottom, and between posts from side to side. This design is shown in Fig. 8. Concealed expansion joints were provided by slots in the posts which received the ends of the rail sections. This satisfied the engineer's requirements as to strength, while to the architect the interesting feature of the treatment lay in the fact that it promises a decorative quality growing unmistakably out of the material, and of being susceptible to such a degree of finish as to avoid the crudeness so often seen.

Decorative Treatment—As a contrast to the sweeping horizontality of the deck, the piers have had their vertical quality emphasized. Strong vertical lines of shadow were created by a control of the pier section. Grooves were run up and down the faces of the piers, their depth decreasing toward the bottom so as to create an effect of diminishing shadow to enhance their interest. The pier corners were beveled, with successively increasing set-backs from bottom to top to create an effect of batter when seen in perspective.

All this detailed treatment was necessarily a matter not merely of the bridge design, but of the bridge as

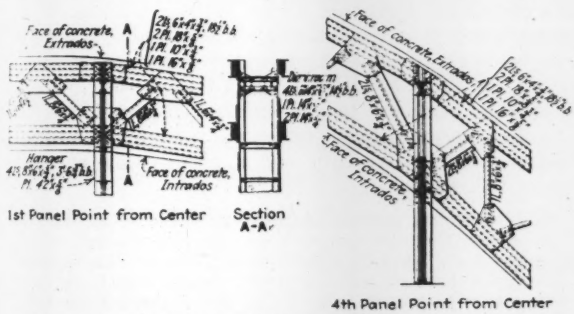


FIG. 7—DETAILS OF STRUCTURAL STEEL FRAMING OF ARCH REINFORCEMENT

a concrete structure. The appropriate expression of the material was a problem of vital concern to the architects. The fact that concrete is at best an intractable material to work with; that its natural decorative value as to color and texture is practically nil; that the cost of any of the known surface treatments to get color and texture artificially was prohibitive; all these were considerations that had to be taken into account.

The scheme of treatment arrived at involved several definite features. No color other than what could be got with the natural concrete and no texture other than what could be got by a control of the form boards was resorted to. In no case was there attempted any effect depending on unbroken surfaces or lines. It seemed to the designers that the tendencies of forms to spring, and of concrete to vary, inevitably doomed such attempts to failure in realization. Continuity of surface and line was considered as the sum of a series of

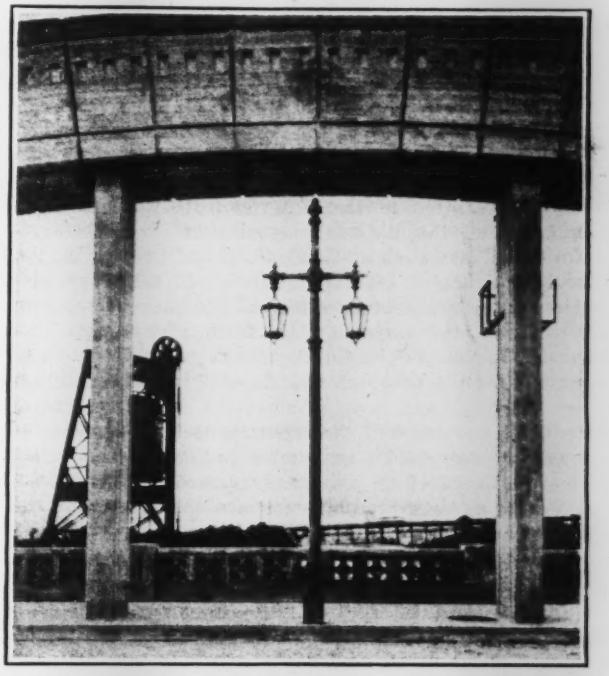


FIG. 8—DECORATIVE TREATMENT OF ROBERT ST. BRIDGE

definitely bounded segments rather than as literal continuity.

The working out of this principle involved the breaking up of all surfaces with lines of light and shade. The natural divisions between periodic runs of concrete were recognized by horizontal grooves, whose location was carefully controlled. Further modeling was accomplished by vertical breaks and grooves, by bevels, and by wedge-shaped indentations. The idea was to make, out of the natural patches of lighter and darker toned material, patterns definitely bounded by strong lines of shadow; and to effect an emphasized interest in light and shade in place of the unattainable color interest.

Engineers and Builders—The Robert St. bridge is the joint undertaking of Ramsey County and the city of St. Paul, represented by Paul N. Coates, county engineer, and George M. Shepard, city engineer. The contractor was the Fegles Construction Co., Ltd., with James Patterson as superintendent and Charles Moore as assistant superintendent. Plans and specifications were prepared by the firm of Toltz, King & Day, Inc., St. Paul, Minn., which also supervised the construction. The personnel of this company was as follows: Max Toltz, mechanical engineer; W. E. King, structural engineer; B. W. Day, architect; Roy Childs Jones, architectural designer; P. E. Stevens, office engineer; W. A. Thomas, electrical engineer; John F. Greene, in charge of arch design and resident engineer. The cost of the bridge and approaches complete is about $1,750,000, including paving, street lighting and engineering.

[*This article will be followed in an early issue by another describing the construction operations and the lessons learned therefrom.*—EDITOR.]

Technical Problems of Steel Construction Discussed by Fabricators

Increased Activity Shown by American Institute of Steel Construction—Structural Research Discussed — To Standardize Fireproofing Requirements — Welding, Corrosion and Wind-bracing

INCREASED co-operation of the industry and a strengthening of interest in the technical problems of steel construction marked the proceedings of the fourth convention of the American Institute of Steel Construction, the national association of steel fabricators, held last week at White Sulphur Springs, W. Va. The attendance of several hundred, and active participation in the numerous sessions of the convention, gave expression to the strength of the feeling for co-operation that has developed in the industry. Something more than half of the program was devoted to technical matters, ranging from beam connections and a structural handbook, discussed in the report of the chief engineer, to welding, corrosion, economies in construction, steel research, fireproofing, and improvements in wind-bracing design as suggested by structural experiences in the Florida hurricane of September.

Business problems of the industry nevertheless maintained a prominent place in the proceedings. Direct selling of steel by rolling mills in competition with fabricators (who are their own customers), and broadening of markets by educational work to set forth the advantages of structural steel, were chief among these problems; others dealt with the use of imported steel, improvement in the relations of fabricator and engineer by the work of local fabricator groups, unreasonable variations in bidding due to imperfect cost accounting, and relations of fabricators to general contractors in bidding.

Brief notes on some of the technical proceedings follow.

Technical Research—Four primary research problems were emphasized in the report of Aubrey Weymouth, of Post & McCord, New York, for the technical research committee. These are (1) structural welding, (2) the structural teachings of the September hurricane in Florida, (3) efficiency of fireproofing and better methods of fireproofing steel, and (4) methods of protecting steel against corrosion. He referred to the investigation recently begun by the American Bureau of Welding, and pointed out that it will probably be necessary to work out new connection details for structural steelwork, to aim to develop continuity, and to study methods of determining the efficiency of welds in finished work. Study of the hurricane effects may prove to be far-reaching enough "to take some of the mystery and all of the hypocrisy out of the subject of wind-bracing." Mr. Weymouth advocated co-operative effort toward having official wind reports expressed in terms of pounds per square foot instead of miles per hour as they are now given.

This last suggestion was also made by Lee H. Miller, chief engineer of the institute, in his annual report. It was again reiterated by F. E. Schmitt, associate editor of *Engineering News-Record*, New York, in an address "Structural Problems Arising from the Florida Hurricane."

Dean M. S. Ketchum, of the University of Illinois, Urbana, discussed structural steel research at considerable length in a stimulating paper, "Research Investigations in Connection with the Structural Steel Industry." He spoke particularly of the need for experimental study of endurance (both of structural steel as such and of structural shapes), impact and vibration in structures other than bridges (particularly headframes and cranes), interrelation of impact and secondary stresses, stress distribution in large gusset plates, structural welding, strength of large rollers, torsional strength of steel members, the strength of rigid frames and open-web trusses, wind pressure effects, earthquake effect on structures, column strength as affected by ratio of column length to maximum dimension of structure, efficiency of fireproofing, and tests of I-beams. He mentioned also the great importance of continuing study of alloy steels, to develop both stronger and more corrosion-resisting structural materials.

Plans for research are included in the institute's program of future activities, but so far it has not been possible to make a beginning in this field.

Fireproofing—Rudolph P. Miller, consulting engineer, New York, presented a discussion of fireproofing. The subject was again dealt with in the report of the chief engineer of the institute, Lee H. Miller, who made the special point that fireproofing requirements should be based on the purpose of keeping the maximum temperature of the framework below 700 deg. F., the point at which steel begins to lose strength. On this basis, and suitable differentiation between main members and secondary members, he proposed a fireproofing specification as follows:

> The skeleton frame of all structures shall be considered as the columns and all girders, beams, trusses or spandrels having rigid connections to the columns. The members of floor or roof panels which have no connection to the columns shall be considered secondary members.
>
> The skeleton frame and secondary members shall be designed and constructed to carry all dead, live and other loads to which they may be subjected both during erection and after completion of the structure. All members shall be such that the stresses which they may carry can be satisfactorily determined by the analytical methods of engineering practice.
>
> The skeleton frame shall provide all the necessary rigidity for the structure, and the floor and roof panels shall not be considered as affecting the vertical rigidity, except that in completed structures the floor and roof panel construction may be designed and considered as carrying horizontal forces to such parts of the skeleton frame as are designed to carry the horizontal forces to the foundations.
>
> The secondary members of floor or roof panels may be rolled structural steel sections or built members. They shall be properly connected to the skeleton frame or

properly supported on masonry walls, hangers, shelf angles, or on the flanges of beams or girders. If supported on masonry walls they shall have a bearing of not less than 4 in., and when supported on hangers, shelf angles, or the flanges of beams or girders, they shall extend not less than 2½ in. past the edge of the supporting part.

The spacing of secondary members in floor or roof panels shall be determined by their capacity to sustain the loads which they may carry, and the load carrying capacity of the floor or ceiling construction between the members.

The unit stress in the parts of the secondary members in floor or roof panels shall not exceed those defined for structural steel.

Built up secondary members in floor or roof construction may be made from rolled shapes, rods, plates, or sheets, and unless encased in concrete shall be properly protected by paint.

If manufactured of sheets the thickness shall be not less than 0.072 in.

Steel secondary members of floor or roof panels shall be considered as fireproofed if protected by an incombustible ceiling and floor construction which will prevent their reaching a temperature of 700 deg. F. in two hours when subjected to a fire which reaches a temperature of 1,800 deg. F. in 30 min. and does not fall below this temperature for the remaining 1½ hr.

The entire floor panel shall be considered fireproof if the steel secondary members are fireproofed as above defined, and if under fire conditions as above defined, with the fire on the ceiling side, a temperature of 300 deg. F. is not transmitted to any part of the top surface of the floor construction.

An incombustible skeleton frame of a structure shall be considered fireproof under the following conditions:

First: When the skeleton has no insulating protection against heat. If the contents which the structure may contain or the adjacent structures and their contents are such that when subjected to fire hazard they are incapable of developing a temperature of 700 deg. F. in any part of the steel in skeleton frame.

Second: When an incombustible skeleton frame has an incombustible insulating protection against heat. If the incombustible insulating material is such that it will prevent any steel part of the skeleton from reaching a temperature of 700 deg. F. in four hours when exposed to a fire which reaches a temperature of 1,800 deg. F. in 30 min. and does not fall below this temperature during the remaining 3½ hr.

The board of directors voted that this proposed specification be submitted to a list of experts with a view to perfecting it prior to incorporation in the institute's handbook of steel construction.

Beam Connection Angles—A set of load tables intended to form an important part of the proposed handbook of the institute has just been completed and published in temporary form. It covers all necessary information on beams, channels and girders used in bending, and is to be supplemented by similar tables covering new structural shapes shortly to be rolled. The tables, Mr. Miller stated, embody the use of 4x3½x⅜-in. and 6x4x⅜-in. angles for beam web connections, departing herein from past practice; the heavier connection angles formerly used are subjected to needlessly large bending stresses because of the erection clearance between beam and girder face, and the new unequal leg angle will help to avoid errors in assembly.

Structural Welding—In a general review of the present status of welding, entitled "Fundamentals of Welding and Their Possible Application to Structural Steel," William Spraragen, of the National Research Council, New York, discussed the relative influences of metal quality, welding rod quality and type, and skill of welder, on the results of structural welding. He pointed out that at present engineers ask for visible evidence of the quality of a weld, but predicted that after experience with structural welding has accumulated such evidence will no longer be called for. A. M. Candy, Westinghouse Electric & Mfg. Co., East Pittsburgh, referred to the five-story all-welded building which his company is now erecting at Sharon, and stated that this structure not only represents a saving of 100 tons (12½ per cent) over a riveted design but also gives opportunity to reduce the corrosion risk by sealing the open spaces at joints. He then reviewed the results of the recent tests of welded structural details at East Pittsburgh, and some prior set of tests.

As counterpoise to these papers, A. F. Jensen, Hammond Engineering Works, Chicago, presented a spirited defense of riveting, particularly for boilers. He claimed that the normalized metal in a rivet has greater fatigue strength than the cast metal in a weld. He also forecast extensive improvements in riveting, such as the use of yoke riveters, alloy steel rivets, cold riveting, multiple riveters, and the like. He expressed apprehension that an unreasoning clamor for the elimination of the noise of the pneumatic riveter may arise.

Corrosion—Supplementing a study of the corrosion of structural steel which he made ten years ago, Frank W. Skinner, of New York, presented an elaborate paper on "Corrosion as Related to Structural Steel." He emphasized that steel properly maintained endures for all time, that cleaning and painting at about seven-year intervals, at a cost not exceeding 60 cents per ton, suffices for complete preservation of outdoor steel, that the possibility of electrolysis of structural steel is still a disputed question (a few buildings have been insulated to prevent electrolysis from current flowing out or through the steelwork), and that it is the engineer's business to take care in design and construction of various points bearing on corrosion protection, such as avoiding pockets and inaccessible places, providing waterproofing aprons over lintels, parging columns with cement mortar, keeping away acid fumes, arranging bridge floors so as to protect the steel against brine drippings, and shielding steel against locomotive blast.

Frank N. Speller, of the National Tube Co., Pittsburgh, in a discussion of Mr. Skinner's paper, described special cases subject to corrosion danger, as coal bunkers, roofing members having imperfect weather protection, concrete reinforcement subject to moisture and electric current, active, and reinforcing material at the sea coast. He said that not enough use is made of copper steel in structures under atmospheric exposure, where this material is known to have special resistance. He also made a strong plea for careful inspection of all steel frame structures that are taken down, and suggested that an organization like the American Society of Civil Engineers should maintain a standing committee for such inspection, to gather experience data both for improved design and construction and for defense against charges and insinuations that the steel framework of our buildings is undergoing unsuspected deterioration.

Structural Steel vs. Concrete—Comparing the structural merits of steel and concrete, Prof. George F. Swain,

of Harvard University, read an exhaustive paper "Steel for Strength and Security." He first listed the virtues of steel, and then entered into a detailed exposition of the shortcomings of concrete, among them the following: that concrete is low in tensile strength, although tensile strength is a highly desirable or even necessary quality in any structural material; that concrete, when permanently placed in the structure, is still in the process of manufacture and undergoes uncontrollable changes for a long time thereafter; that temperature and moisture are constantly changing the volume of concrete, thereby setting up continuous and variable internal stresses; and that concrete is highly susceptible to a large number of imperfections in both materials and workmanship. This last point Professor Swain illustrated by several dozen photographic views of concrete structures suffering from glaring initial defects or from subsequent disintegration, ranging from sewage basins and railway wing walls to the Bloomington Stadium, the Vincent Hotel at Benton Harbor, and the Douglas Memorial Bridge over the Klamath River.

Professor Swain stated that he is in no way against the use of concrete or reinforced concrete "where they are most suitable," but that he believes that "reinforced concrete is being used for many purposes where steel is far superior." He did not indicate the particular uses, however, in which he considers concrete most suitable or those in which steel is superior.

Architecture and Steel Construction—Harvey W. Corbett, architect, New York, and Wilbur J. Watson, engineer, Cleveland, dealt with architectural subjects. Mr. Watson, on "Better Architectural Design in Steel Bridges," gave a pictorial review of noteworthy bridge construction throughout the ages, in stone concrete and steel, and emphasized the often denied beauty of well planned steel bridges.

New Views on Wind Bracing—In a review of structural observations and effects in the great hurricane in Florida six weeks ago, F. E. Schmitt, of *Engineering News-Record*, New York, stated that conclusions of far-reaching effect on structural practice are likely to follow from a study of the storm effects. The effects are now under study by a committee of the American Society of Civil Engineers, but the speaker indicated some possible conclusions, as follows: (1) Buildings are subject to real and not imaginary lateral attack, and this of large amount; (2) Wind pressure in severe storms may be much higher than heretofore thought probable, perhaps reaching amounts in excess of 60 lb. per sq.ft.; (3) the effect of wind gusts, hitherto ignored, may prove to be of decisive importance, and may require a study of wind pulsations and their relation to rigidity; (4) the behavior of certain buildings in Miami indicates that floors distribute lateral forces very perfectly throughout the framework; (5) the floor girders are stiffened by the floors and may be considered practically rigid, thus changing the conditions underlying the design of wind bracing systems; (6) relatively simple column connections may suffice to develop the required bending strength of the frame, making it feasible to engage all columns in a building in wind resistance, and permitting a considerably simplified development of wind bracing; (7) walls share in lateral resistance, but must have their strength and stiffness correlated with those of the framework; (8) longitudinal wind pressure may be important; and (9) higher wind stresses may be applicable to maximum wind forces.

Possible Economical Design—Prof. C. R. Young, of the University of Toronto, in a paper "Some Possible Economies in Steel Construction" reviewed details of steel design that should be subject to further inquiry, and that offer opportunities for economy. Saving of metal, he said, cannot go on indefinitely, nor can the reducing of the factor of safety or increase of unit stresses proceed much further, the limit in some classes having already been reached. However, the following possibilities for saving were enumerated: The prescribed live-load for buildings has too much variation in the different codes and particularly there is too much difference in the percentage of transmission of live-load to column. Most building codes require too high a transmission ratio, much higher than will probably be realized in actual construction. Professor Young proposed a rule of his own for the reduction of live-load transmission to column, which starts at the roof with 100 per cent, and assigns to the first floor below roof a 15 per cent reduction which, combined with the 100 per cent roof load, gives a 90 per cent reduction, and so on down through until the tenth floor and below has a reduction in coefficient of about 50 per cent. Another saving in design might be made by proper consideration of the distribution of positive moment in steel beams by reason of end restraint in riveted connections. There is only one code, that of the Canadian Engineering Standards Association, that allows such a reduction. Further economies might be had by utilizing the reinforcing value of concrete encasement, or haunching, for steel beams, and the author referred to tests that have been made by the Dominion Bridge Co., which showed economy in such use. Allowable column eccentricity in tiers of columns is something further to be investigated, as is the effective value in tension of angles with outstanding legs. The last possible saving discussed was the omission of lateral bracing in the floor plane in bridges where concrete flooring is laid across the top of the floorbeams.

Institute Activities—According to the report of Charles F. Abbott, Executive Director, a satisfactory financial condition developed from the action taken a year ago in raising the dues of members to 15c. per ton fabricated. During the coming year this rate of assessment is expected to yield about $200,000, and the institute will engage in an educational campaign directed both to the dissemination of information among architects and engineers through a structural steel handbook soon to be issued, and to the education of the general public to the merits of steel construction as assuring strength and security.

Miniature Railway in England

A railroad curiosity is the 8½-mile Romney, Hythe & Dymchurch Ry., in England, which has a gage of only 15 in., but it intended to handle general passenger and freight and seashore excursion traffic. One end enters the terminal yard of the Romney branch of the Southern Ry. and the other end is adjacent to a bus terminal in the town of Hythe. Four-wheeled passenger cars seat eight persons each, and the four-wheel open freight cars are 1-ton cars. The locomotives are miniatures of main line engines of 4:6:2 and 4:8:2 types, the former weighing about 8 tons. Several small streams are crossed and there is a 56-ft. through truss span.

Concrete Dry Dock Completed in Twelve Months

Old Wooden Dock at St. Johns, Newfoundland, Torn Out and Replaced by Modern Concrete Structure—Mixing Plant Moved Down Dock Floor, Finishing as It Moved

By William I. Bishop, Ltd.
Constructing Engineers, Montreal, Canada

A MODERN concrete dry dock, with all the equipment and accessory structures dictated by the most recent practice, has replaced the old wood structure which has served shipping at St. Johns, Newfoundland, since 1884. As the new dock literally replaced the old—occupied the same site—rapid construction was urgent so as not to suspend dry-dock service longer than necessary. The construction time was put at 12 months and contract was awarded to William I. Bishop, Ltd., constructing engineers, on plans prepared by them, May 13, 1925. The first vessel was docked May 19, 1926. This was just found possible by night and day construction using modern equipment.

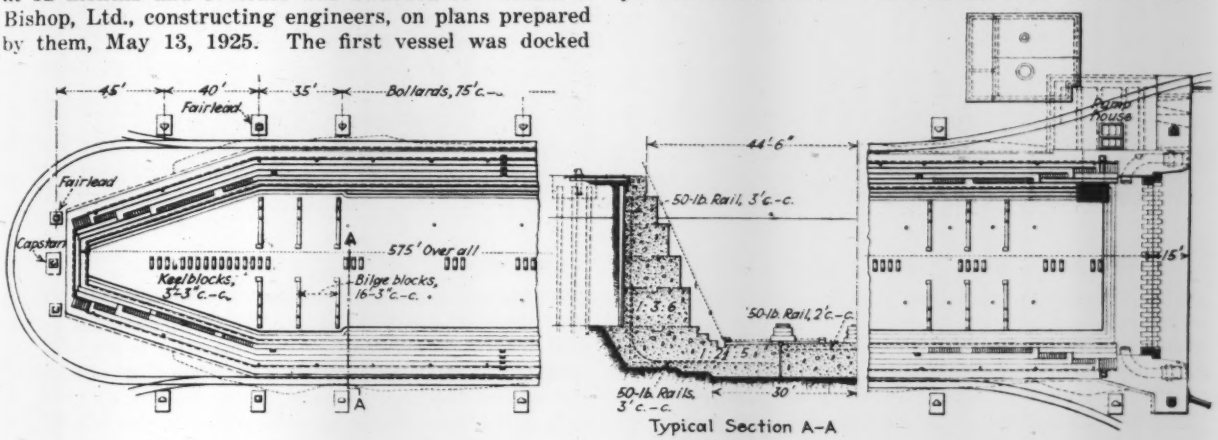


FIG. 1—NEW DRY DOCK AND DOCK STRUCTURES AT ST. JOHNS, NEWFOUNDLAND

Dry-Dock Structures—The new dry-dock structures are indicated in character and dimensions by Fig. 1. The principal dimensions of the dock proper are:

	Top		Bottom	
	Ft.	In.	Ft.	In.
Length	577	3	575	0
Width	89	0	70	0
Gate	76	5.5	70	0
Depth over sill	27	0 at H.W.	23	3 at L.W.
Depth over floor	31	0 at H.W. at outer end	27	3 at L.W.

The dock is of concrete construction throughout with the exception of the gate stop which is of granite. The dock chamber is of chief construction interest. The general arrangement of the walls follows the customary practice for docks of this type, except that it was necessary to put in more altars than usual on account of the varied nature of the shipping using the port of St. Johns. In addition to the coastal steamers belonging to the railway and ocean-going vessels up to the limit of its size, the dock has also to be available for the fishing schooners which form so large a portion of the local trade. However, the heavy invert is more notable as affecting construction. The design of the invert was governed by the nature of the cemented gravel. Although this material could be counted on to form a very satisfactory foundation from the bearing point of view, it was considered necessary in all calculations owing to the porosity of this gravel, to figure on full hydrostatic head due to the tide. As the gravel occurred uniformly about 23 ft. below low water mark throughout the whole area of the dock, it was possible, by pouring the concrete in the base of the side walls directly against it, to consider it as taking the side thrust arising from the hydrostatic pressure on the under side of the invert.

Old 50-lb. rails, of which a large supply was on hand, were used to reinforce the side walls and invert. The thickness of the latter was 7½ ft. throughout the greater portion of the work. Towards the outer end, owing to the less compacted nature of the cemented gravel, it was first of all found advisable to extend the center rails in the invert into the side walls and latterly, where the excavation had to be carried down behind sheeting, the thickness was increased by stages to a maximum of 9½ ft. in way of the cross drain inside the sill. Two 3-in. vertical relief drains were placed in each section constructed. Several of these discharged freely when the dock was unwatered, while all of them showed a pressure practically equal to that due to the tide.

Unwatering and Excavation—Construction started with removal of the old dock structure. Two traveling derricks running side by side, Fig. 2, on rails were erected above the floor of the dock, and temporary tracks for the disposal of excavated material were laid along the old cope on the existing timber piling. The excavation was handled mainly by orange-peel buckets loading direct onto flat cars. These derricks handled the work of excavation very successfully from start to finish, but considerable difficulty was experienced in the removal of the old dock altars which had been thoroughly cross drifted to the bearing timbers, making it necessary to remove them in very short sections.

The problem of keeping the work unwatered proved to be greater than anticipated, owing to the porous nature of the bottom and the none too sound condition of the sheetpiling around the old dock. It was decided to build a cofferdam across the entrance, leaving sufficient room for the construction of the new entrance and connect up with the old sheetpiling on either side. Tests

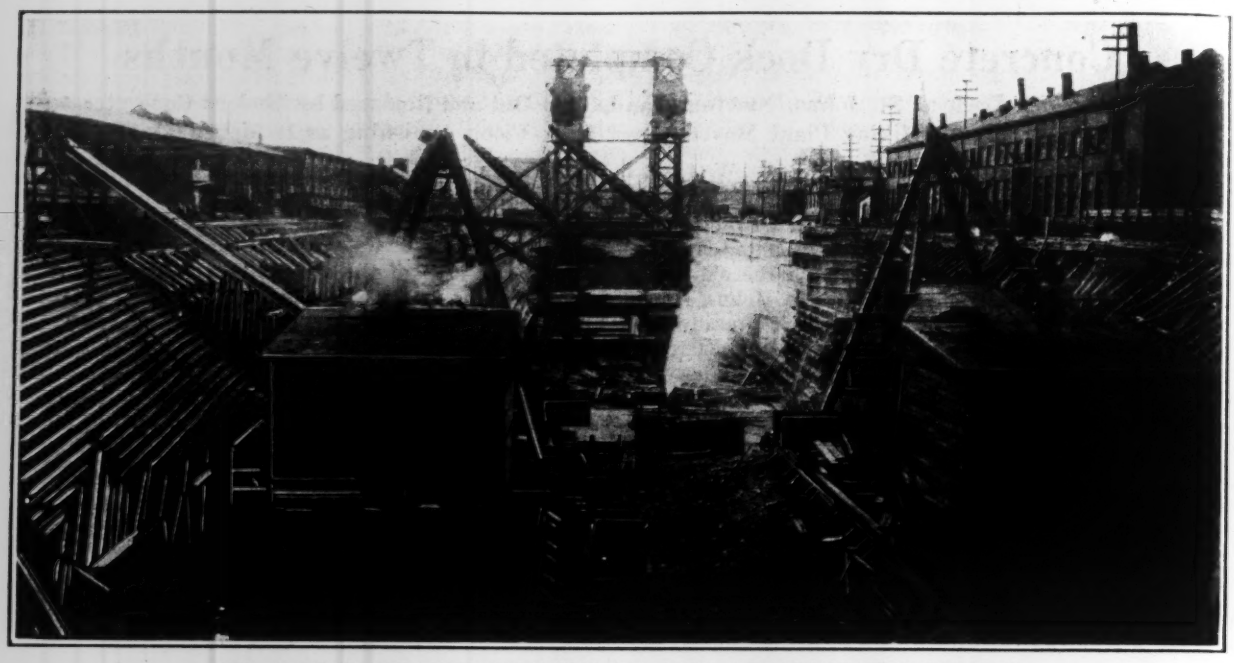


FIG. 2—TWIN DERRICKS TORE OUT OLD DOCK AND EXCAVATED FOR NEW
These derricks backed down the dock chamber and prepared the emplacement for the new dock walls and invert.

made by driving a steel rail had indicated that it was possible to get a penetration of 4 ft. into the cemented gravel and it was decided to dredge down to this level and use steel sheetpiling supported by an earth-filled crib. Steel sheetpiling 42 ft. long was used, and no difficulty was experienced in driving it or in pulling it subsequently. The crib was constructed of birch logs, the only material available, with a floor made of old dock timbers thoroughly drifted and wired together. It was built and sunk in position being framed on 4x12-in. posts with cross logs every 7½ ft. The maximum head due to the tide was 33 ft. After the sheetpiling had been driven, an earth toe 15 ft. high was placed in front to minimize the risk of a blow. While the cofferdam was being built, the old gate was utilized to keep the water out of the dock and it was not removed until the cofferdam had successfully withstood a spring tide. It is interesting to note that so small was the leakage through the cofferdam that one 3-in. pulsometer unwatered the area between it and the gate.

Some difficulty was experienced with the excavation in the early stages owing to the caving in of the banks. As it was impossible owing to the presence of buildings on either side to allow them to take their natural slope, it was feared that it might be necessary to use sheeting from the start. However, it was soon found that the timber piling of the old dock, with a little additional bracing, could be successfully used for holding the sides at a sufficiently steep slope. This involved dividing up the pressure as evenly as possible by stepping the banks

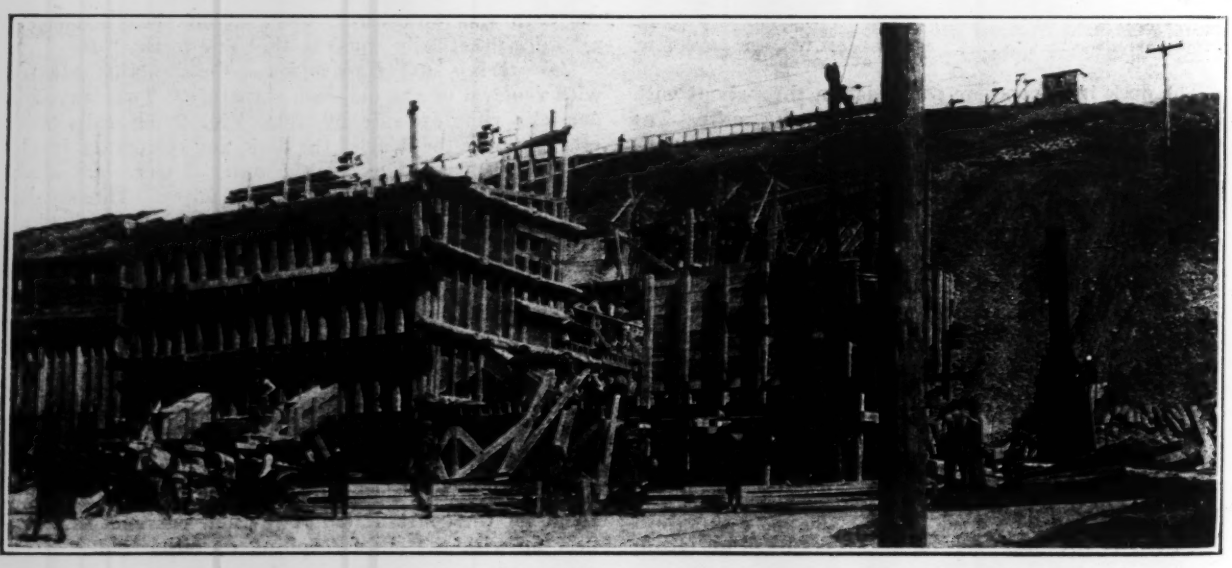


FIG. 3—CRUSHING PLANT FOR CONCRETE AGGREGATE INSTALLED FOR JOB

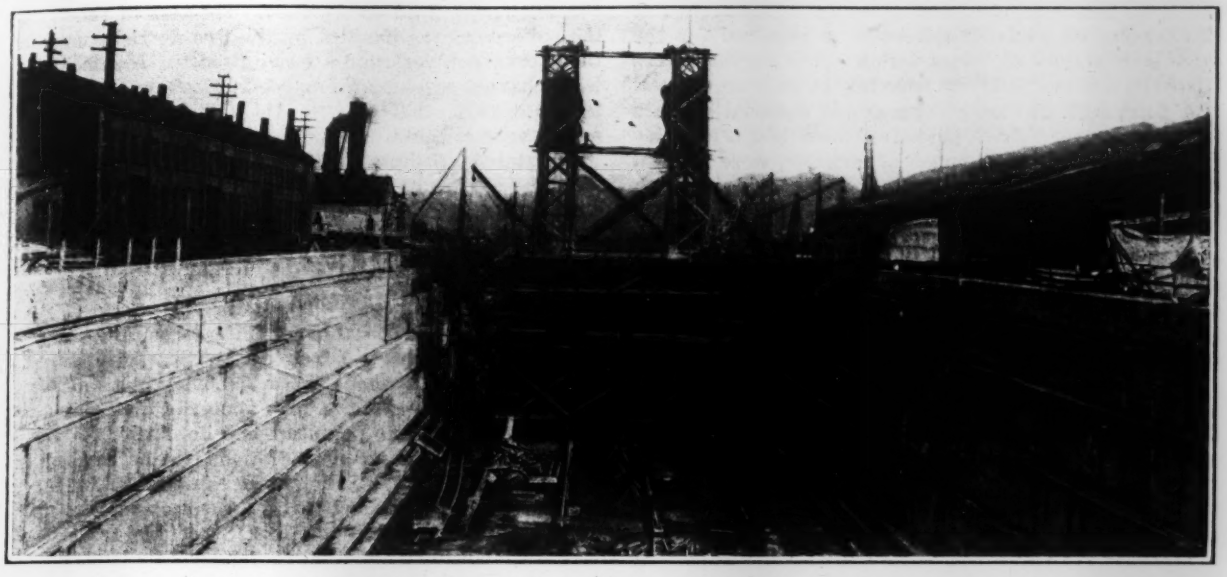


FIG. 4—MAIN MIXING AND CHUTING PLANT TRAVELED ON DOCK FLOOR

by hand to form a vertical face of about 10 ft. along each row of piling.

Concrete Construction—While the excavation and the cofferdam work were proceeding, arrangements for placing the concrete were being pushed forward as rapidly as possible. A good supply of an excellent quality of sand had been located at Trepassey, some 110 miles from St. Johns, and arrangements for its transportation made with the railway. Cement was obtained by boat direct from Montreal. In order to obtain stone it was necessary to open a quarry on the South Side Hills, about a quarter of a mile by road from the site of the work. The working face was located about 600 ft. up the hillside and the rock conveyed to the crusher plant at the foot, Fig. 3, by a two-car gravity-operated system controlled by a brakedrum half-way down the slope. This plant consisted of two 12x24-in. crushers, one pulverizer and bins for storage. The crushed rock was conveyed to the works by teams. A stiff-leg derrick laid up stock piles of sand and stone.

For pouring the head end of the dock, a small bin was built for the sand and stone and a short inclined track leading up to the mixer at the edge of the old dock. The material was hauled from the bin in a car fitted with measuring boxes and dumped straight into the mixer by opening a gate in its side, the empty car returning to the bin by gravity. A short tower and spout were used to elevate and distribute the concrete to the work.

As soon as the first 72 ft. of the floor had been completed, a start was made with the erection of the main concrete plant, Fig. 4, which had been specially designed to meet the peculiar conditions. This plant consisted of

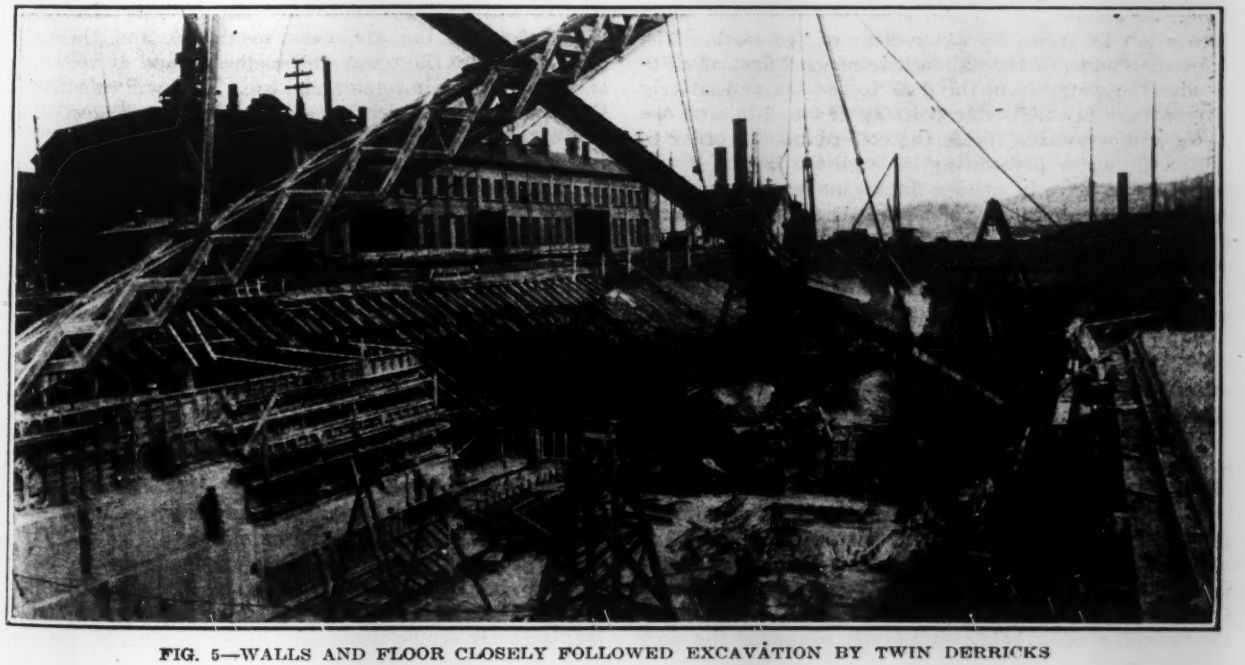


FIG. 5—WALLS AND FLOOR CLOSELY FOLLOWED EXCAVATION BY TWIN DERRICKS

two 1-cu.yd. mixers, each with towers and chutes capable of reaching all parts of the work as required for the successive stages of construction. The mixers were located on a heavy platform traveling on rails on the new dock floor, with the batch hoppers and material bunkers arranged above. These bunkers, which had a capacity for the equivalent of 90 cu.yd. of concrete, were reached from both sides of the dock by temporary bridges which were moved forward with the mixer plant itself.

The concrete throughout the main portion of the work was placed in 36-ft. sections. As soon as a section had been excavated, the center portion of the invert was poured, leaving a haunched construction joint at the base of the side walls. Sheet copper cutoffs, 12-in. wide, were placed in every joint of invert and side walls. Both mixers were often used simultaneously on this part of the work. The bases of the side-walls were then poured, followed by the walls altar by altar. The mixes used were 1:2½:5 in the invert (with a certain amount of 1:3:6 in the center) and the base of the side walls, and 1:3:6 in the walls. A 1:1½:3 concrete 9 in. thick was used on all faces, a temporary movable form being used to separate the two mixes when pouring the walls. At the outer end, however, on account of the treacherous behavior of the banks it became necessary to excavate and concrete in short sections behind sheeting.

A start was made with the concrete work July 13, 1925, and the main portion of the dock, including the return walls at the entrance, was completed by Feb. 28, 1926. The weather prior to the end of November was particularly favorable for concreting operations, but after that date it became necessary to heat all materials and take cold weather precautions. More trouble was experienced during the winter months from the variable character of the weather than from actual lowness of temperature. High winds and heavy snowstorms were followed by rain, mainly in above-zero weather.

Drainage—Two 8-in. pumps were used to keep the excavation dry during the construction period although more pumps than this had to be available. A series of sumps connected by a 2-ft. square wood flume were dug along the center of the old dock ahead of the main excavation to drain the water clear of the work. The drainage pumps of the old dock were used first of all to remove the water from the dock to the sea and latterly a temporary installation, consisting of two 8-in. and one 10-in. pumps located inside the cofferdam. In order to collect the water percolating through the banks, it was necessary to leave in wooden flumes under the toe of the side walls, temporarily connecting them to the center drain while pouring a section of the invert. The last sump, situated just inside the sill, was kept open until all the concrete work had been completed and the dock was ready to be flooded. The concrete was placed in three lifts up to the pump room floor level and the machinery set in place during the construction of the walls. Soldered copper strips used in all construction joints produced an absolutely watertight job.

The total quantity of concrete in the work is 34,818 cu.yd. and the total excavation amounted to 30,300 cu.yd. of earth and 23,111 cu.yd. of cemented gravel.

Opening the Dock—In the meantime the erection of the caisson, which had been fabricated in England and shipped to St. Johns in January, was proceeding in the completed portion of the dock. By the middle of April it was ready to be floated off the ways and the work on the pumping plant being sufficiently advanced the dock was allowed to flood on April 26. The task of removing the cofferdam was handled by the two derricks used in the excavation work and a steam dredge. A sufficiently wide channel was created in about three weeks and on May 19, 1926, the S.S. "Portia," one of the government's coastal boats, was successfully docked.

As stated, William I. Bishop Limited of Montreal were the engineers and contractors for the entire work with A. D. Swan of Montreal as consulting engineer.

Research on Higher Transmission Voltages at Stanford

EXPERIMENTAL work is just beginning in the Ryan high-voltage laboratory at Stanford University in California where three 350,000-volt transformers make possible for the first time the artificial generation of electrical potentials up to 2,100,000 volts. With this new equipment research is to be carried on under Dr. Harris J. Ryan that is expected to influence materially the design and perhaps the economical length of high-tension transmission lines. Structural features of the new laboratory building, particularly its large doors, were described in *Engineering News-Record*, Aug. 19, 1926, p. 304. The following has been taken from a statement by Dr. Ryan, outlined for *Electrical World*.

All forms of conductors that are thought suitable for 220,000-volt transmission will be tested. Cables about 1 in. in diameter with hollow core, rope lay, concentric lay and other forms and shapes will be tried, some of which will employ enamel and oxide films of various sorts. The perfection of a 150,000-volt wattmeter at Stanford has made possible the measurements of extremely small power losses that occur with corona, insulator leakage and capacitance to ground. With this instrument losses below 10 kw. per mile will be analyzed.

Based on tests with a hollow-core copper conductor 1⅛ in. in diameter, under 220,000 volts and later with a similar conductor 2 in. in diameter for 440,000 volts, the plan is to develop a conductor with which tests will be made at voltages on the order of 880,000. These studies will be directed toward determining electrical losses through the air, over insulators and through conductivity to the tower and to the ground at voltages above those now in commercial use. This will constitute the basis for the selection of a group of voltages next above those now used commercially on which further research can be concentrated.

Ten cycle studies will now be resumed at 350,000 volts and Dr. Ryan suggests that the most economical range of power transmission frequencies will probably lie between 10 and 60 cycles for distances greater than those now covered with 220,000-volt lines.

Particular attention will be given to high-voltage insulators with respect to losses over insulators. The electrical characteristics of high-voltage insulators have been well established but more information about losses is needed, particularly with reference to (1) surface conditions, (2) surface charge and (3) space charge. A study will be made of electrical breakdown values of tower clearings with insulators in different positions.

The laboratory and equipment exclusive of land represents an investment of approximately $275,000. The six large transformers were designed and donated by the General Electric Co., while sums for the building and other equipment were raised largely by six California power companies.

Straightening the Chicago River Involves Many Problems

Divided Railway Property to Change Owners—New Streets and Bridges Will Relieve Traffic—Cost, $5,000,000

THE IMPORTANT Chicago project of straightening the river through a busy section of the city has practically reached the construction stage after many years of agitation and negotiation. Between Polk and 18th Streets, a distance of about 5,300 ft., the river makes an eastward curve or arc having a rise of about 865 ft. This channel prevents the extension of streets running south from the business district, so that there is increasing congestion on the present streets. The total area of land involved, between Polk, Canal, 18th and Clark Sts., is about 260 acres. At present the river bend comes within about 150 ft. of Clark St., but the new channel will be parallel with and about 1,015 ft. from that street.

Street Conditions—Within an east and west width of about a mile at this part of the city there are thirteen north and south streets, but only five are continuous thoroughfares, the others being interrupted and blocked by railway property occupied by tracks and other facilities. Three consecutive thoroughfares are Michigan Ave., Wabash Ave., and State St.; then come dead-end streets; Clark St. is the next thoroughfare and then Canal St. on the west boundary of the district involved and outside of the congested business section of the city. With the channel straightened, it is proposed to open up three more streets, by connecting present dead ends. These are Dearborn, Sherman and Franklin Sts., as shown on the plan.

In an east and west direction there are four streets across the district: Polk, Taylor, 12th and 18th Sts., the distance between the two last being about ¾-mile. It is proposed to extend two new streets eventually, at 14th and 16th Sts., as shown. Practically all these streets are and will be on viaducts crossing the railroad property.

Railroad Conditions—The street plan situation is complicated by the fact that practically the entire area of the district, and practically all the river front property, is owned by a number of railroads and is occupied by main tracks, freight yards, engine terminals and freight terminals. To cut through this property with a new and direct river channel will entirely upset property lines and dislocate track layouts.

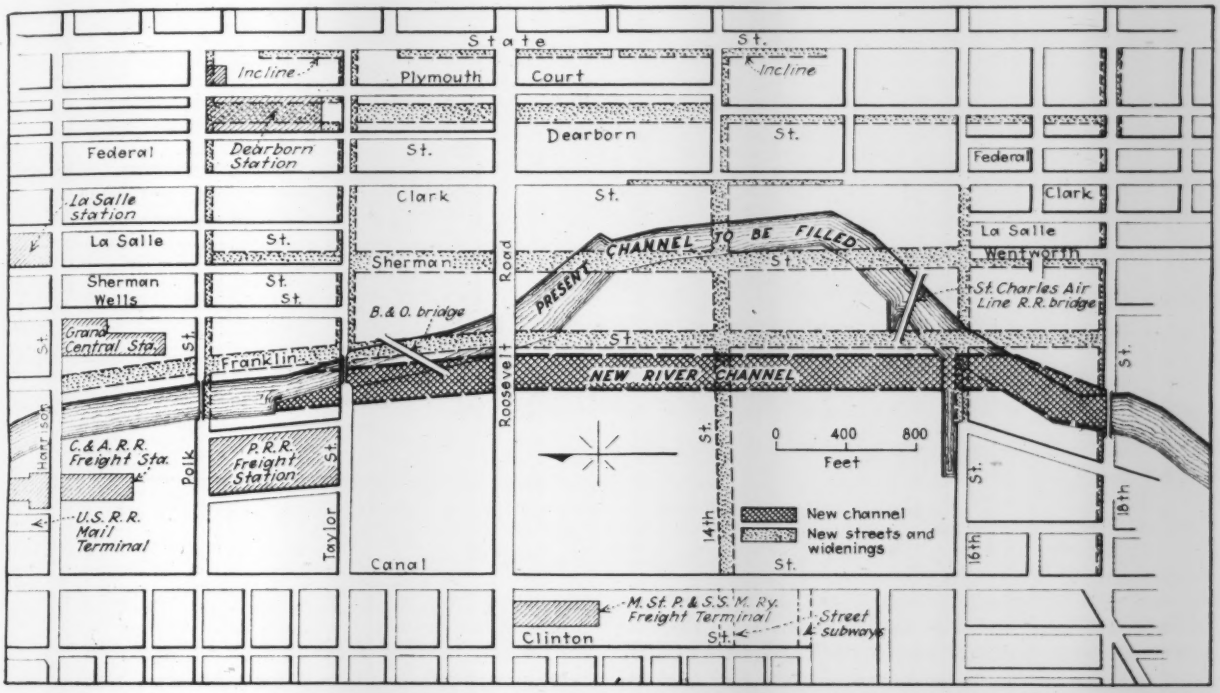


FIG. 1—RIVER STRAIGHTENING PROJECT AT CHICAGO, SHOWING NEW, DIRECT NORTH-SOUTH CHANNEL

Planning a rearrangement of tracks and railroad facilities is not an easy matter and is made more difficult by the necessity of providing for the several new street viaducts crossing the site.

Successful Co-operative Plan—After several years of protracted negotiations, rendered fruitless by the impossibility of harmonizing the conflicting interests and securing their combined action, the mayor in 1925 appointed a citizens' committee composed of five prominent business men. As a first step, this committee succeeded in getting the railroad authorities to appoint an executive committee of high officials to represent the railroads as a whole. And this railroad committee later appointed a joint committee of engineers representing the railroads. Following this came the valuation of the lands concerned, and the railroads finally accepted a proposed plan for the transfer or interchange of property, so that no company will have property on both sides of the river, except for two narrow strips of right-of-way extending east and west across the district involved.

The final report of the citizens committee, accom-

panied by letters from the railroads accepting the plan, with some minor reservations, was sent to the city council in December, 1925. In July, 1926, the council passed an ordinance for the improvement as planned in the report, and requiring the acceptance of the ordinance by all parties concerned by Oct. 10.

A permit for the channel change was issued to the city by the War Department in 1924, requiring that work should be commenced before the end of 1926.

Construction Work—As the old channel must be kept open for navigation until the new channel is ready for service, the material excavated for the latter will be carried out into the lake and either dumped in deep water or utilized for filling reclaimed lands for the new lake-front park system of the South Parks Commission. In the latter case, the park commission will pay for the fill. After the old channel is abandoned and closed by bulkheads, it will be filled with clean sand dredged from the lake and pumped into place by the dredges.

The new channel, Fig. 2, will be 200 ft. wide, with a depth of 26 ft. of water on a bottom width of 100 ft., reducing to 16 ft. at the sides. On each side will be a concrete dock wall, built as shown in Fig. 2, with its top 4 ft. above water line. Where the new bulkhead line is in what is now solid ground, the wall will be supported on two rows of round piles, with a row of triple-lap wood sheetpiling between them. Where this line comes within the present channel, the sheeting will be omitted but in the front row the piles will be driven close together to retain a rock fill. In both cases, the outer row of piles will be tied back to anchor piles by means of 1½-in. rods. Where the bulkhead or dock line is within the present channel but rock is too near the surface to admit of piling, the concrete dock wall will be built on a rock filled timber crib 26 ft. wide. These three forms of construction are shown in Fig. 2.

The engineering design involved in this extensive improvement is comparatively simple. It includes the new river channel, dock walls, bridges, streets and viaducts, and the rearrangement of railway tracks and terminal facilities. In the construction of these works, however, serious difficulties will be encountered, since operations will be carried on in restricted space and under the necessity of maintaining river traffic and railway traffic, the latter including freight yard and freighthouse service as well as train service. One exceptional problem is the bascule bridge of the St. Charles Air Line, which will be left high and dry, its main pier being on the east instead of the west side of the channel. Here it was proposed to turn the bridge around upon its pier, as described in *Engineering News-Record* of Dec. 25, 1919, p. 1060. A similar plan was proposed for the new Roosevelt Road bridge, to be built. As for city bridges, those at Polk St. and 18th St. will remain unaltered. New bascule bridges will be built at Taylor St. and Roosevelt Road, and eventually similar bridges for the extensions of 14th and 16th Sts. Two existing railroad bridges and two existing street bridges are affected, apart from the two additional street bridges proposed by the city.

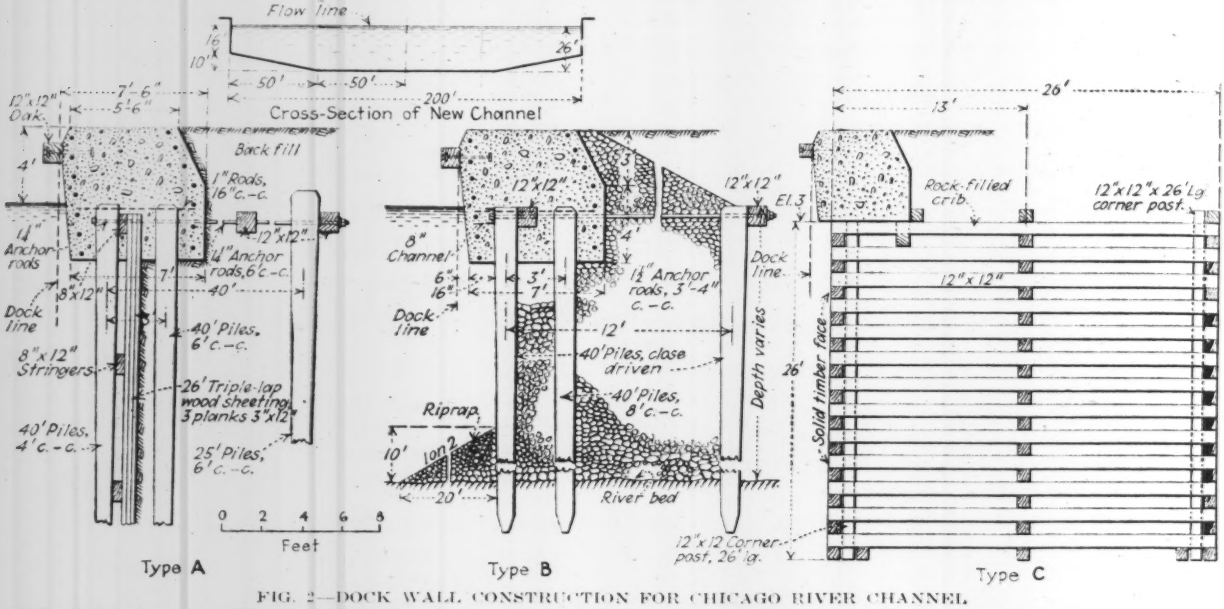


FIG. 2—DOCK WALL CONSTRUCTION FOR CHICAGO RIVER CHANNEL

A—Typical design. B—Pile crib design where line of new channel lies in present channel. C—Timber crib design for same situation as B, but where rock prevents use of piles.

Cost and Valuation—Following the appointment of a committee of railroad executive officers to consider the river straightening problem and its effect upon railroad business and property, that committee appointed a committee of railroad engineers to prepare plans and estimates and to confer with the engineers representing the city and the citizens' committee.

Estimates of cost and land values as prepared by engineers representing the railroads and the city differed very widely, but by getting the engineers to work together or in co-operation these differences were reduced, eliminated or compromised until finally a cost and valuation were arrived at that were acceptable to both sides. It was held that the railroads should pay amounts representing the increased values due to gain in area and to transfer of land from the west to the east side of the channel. Furthermore, in revising property lines through transfer of lands between the different companies, consideration was given to the

STRAIGHTENING THE CHICAGO RIVER

A—Land Values		
1. Present total value of lands; (41.4 acres)		$10,314,070
2. Value of land for new channel	$3,450,300	
3. Value of land between old and new channel	4,681,000	
4. Increased value of No. 3 by 33 per cent due to transfer to east side	1,560,300	
5. Value of land reclaimed (old channel)	6,341,000	
6. New total value of land (item 1 minus 2, plus 4 and 5)		$14,765,070
7. Balance available for construction		$4,451,000
B—Construction Cost Estimate	Original	Modified
1. Constructing new and filling old channel	$3,363,160	$3,238,880
2. Two railroad bridges over river	825,000	725,000
3. Rearrangement of railway facilities	952,994	899,296
4. Sewers, water mains, etc.	70,000	70,000
5. Buildings and miscellaneous facilities	650,000	460,000
6. Changes in railway grades for new bridges	1,097,470	
7. Property damages		175,000
Total	$6,958,624	$5,568,176
8. Interest during construction	626,276	
9. Credit for filling in park		400,000
Net grand total	$7,584,900	$5,168,176

future economic situation of the railways as a whole, in addition to their existing rights. For the land values, each lot or parcel was appraised, by a valuator appointed by the citizens' committee.

Three main points were considered by this committee: (1) Cost of construction works involved; (2) valuation of the original property, of the reclaimed land of the abandoned channel, and of the property transferred from the west to the east side of the channel; (3) ownership of land after the improvement, including the reclaimed land. The cost of opening new streets and building additional bridges over the new channel was not included, as these would be required even if the channel was not changed.

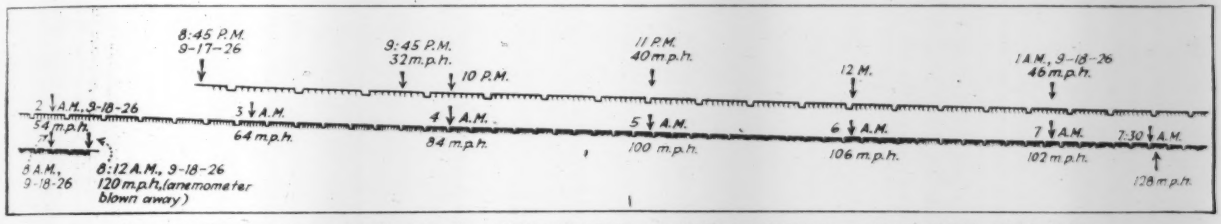
To summarize the financial results, the net construction cost was figured at $4,893,176. The river straightening fund will receive $7,500,980 from five railways, representing the value of the additional land they will gain. From this fund $4,297,750 will be paid as compensation for land taken. The remaining sum of $3,203,230 will be available for the construction cost of $4,893,176, leaving $1,689,946 to be supplied by the city towards this cost. These figures are general and are subject to modification. A summary of the valuation and cost figures is given in the accompanying table.

Engineers—On behalf of the city, the river straightening problem was handled by E. J. Noonan, consulting engineer for the council committee on railway terminals and for the citizens' committee; Hugh E. Young, engineer for the Chicago Plan Commission, and John Ericson, city engineer, and C. D. Hill, engineer of the Board of Local Improvements. For the railways, E. H. Lee, chief engineer of the Chicago & Western Indiana R.R. was chairman of the board of railway engineers appointed to deal with the project for the railway interests as a whole, and acting for the joint committee of railway executives. In general, the city was represented by A. A. Sprague, commissioner of public works, and by Silas Strawn, lawyer, chairman of the citizens' committee. The railways were represented by J. E. Gorman, president of the Chicago, Rock Island & Pacific Ry., as chairman of the joint committee of railway executives. It is expected that the first contracts will be let and work begun before the end of 1926.

Hurricane Wind Record Taken at Miami Beach, Fla.

NO satisfactory wind record in the Florida hurricane of Sept. 18 was obtained at the Weather Bureau Station at Miami, as reported in *Engineering News-Record* of Oct. 7, p. 586. But an anemometer at Allison Hospital, on Miami Beach, three or four miles farther east, recorded the hurricane velocities during the larger part of the storm. A copy of the chart is here reproduced, through the courtesy of the U. S. Weather Bureau, which received the original of the chart from Dr. Scott R. Edwards, superintendent of the hospital.

The anemometer and register had only recently been


8:45 P.M. 9-17-26
9:45 P.M. 32 m.p.h.
10 P.M.
11 P.M. 40 m.p.h.
12 M.
1 A.M., 9-18-26 46 m.p.h.
2 A.M., 9-18-26 54 m.p.h.
3 A.M. 64 m.p.h.
4 A.M. 84 m.p.h.
5 A.M. 100 m.p.h.
6 A.M. 106 m.p.h.
7 A.M. 102 m.p.h.
7:30 A.M. 128 m.p.h.
8 A.M., 9-18-26
8:12 A.M., 9-18-26 120 m.p.h. (anemometer blown away)

REPRODUCTION OF MIAMI BEACH ANEMOMETER CHART IN HURRICANE OF SEPT. 17-18, 1926

installed, and some test runs had been made. At the approach of the hurricane a clean sheet could not be found, and the test sheet was therefore used; the reproduction is copied from the lower part of this sheet. The register was started at 8:45 p.m., Friday, Sept. 17, and continued in operation until 8:12 Saturday morning, Sept. 18, when the anemometer blew away. Because of some defect in the connections of the direction-recording circuit, no record of wind direction was obtained, but presumably it was northeast during the night, continuing until about six in the morning, and later was east or southeast. The hospital is located in the extreme northern part of Miami Beach, a little over six miles northeast by north from the Miami weather station, in the postoffice.

No lull such as was observed in Miami was noticed at the beach station. At 6:25 a.m. the wind fell to 78 miles an hour, from a rate of 108 miles per hour which had prevailed only a few minutes before, but the velocity soon increased again, and reached a maximum at 7:30 a.m., amounting to 128 miles per hour. At 8:12 a.m., when the anemometer blew away, it was recording a velocity of 120 miles per hour.

Virginia's New Through Route Highway

Virginia on Nov. 17 will celebrate the opening of the state's first completed hard-surfaced through state highway, leading from the Virginia line at Martinsburg, West Virginia, south for more than 500 miles to Cumberland Gap. The celebration will take place at Christiansburg, Va. Northern and southern states whose highway systems will be united by the completion of this road will be represented by their governors.

Structures on a Texas Water Service District

City Supply and Irrigation System at Wichita Falls—Numerous Combination Drops, Culverts and Spillways—Concrete Spillway in Earth Dam—Concrete Siphon and Flume

By J. L. Lochridge
Consulting Engineer, Dallas, Texas

THE IRRIGATION and domestic water supply project of Wichita County Water Improvement District No. 1, completed in 1925, was built primarily for the water supply of the city of Wichita Falls, Texas, but it provides sufficient water to irrigate about 100,000 acres of land along the Wichita River and

FIG. 1—SPILLWAY AND HEADGATES: WICHITA FALLS DAM
Crest of concrete spillway in center. Earth dam curving away at the left. Canal headgates at right.

Holliday Creek. About 30,000 acres are under irrigation at this time. This project was described in *Engineering News-Record*, June 21, 1923, p. 1080, and its diversion and storage dams, June 28 and Dec. 20, 1923, pp. 1118 and 1004. The present article deals mainly with the distribution system, which includes the South Side, North Side and Holliday main canals, with the smaller canals or laterals for distribution. The Holliday canal, however, is not yet built, and a separate district may be organized to finance it. A view and general plan of the diversion dam and headworks are given in Figs. 1 and 2.

It is believed that the duty of water for crops will not average more than 18 in. per year. The main

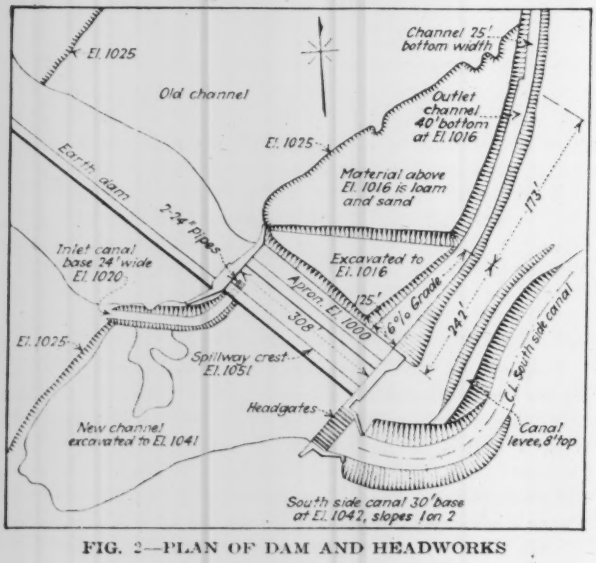


FIG. 2—PLAN OF DAM AND HEADWORKS

canals are designed for a duty of 100 acres of land per second-foot at the headgates, for which an average annual rainfall of 29 in. will be sufficient. In the distribution of water to the water users, the rotation method is used and the small laterals are designed to deliver 5 sec.-ft. to each 40-acre tract every ten days. Lake Wichita, the source of the present water supply for Wichita Falls, will be filled from the South Side canal during the non-irrigating season.

Ordinarily, all canals and levees have inside slopes of 1 on 2 and outside slopes of 1 on 1½ for the levees,

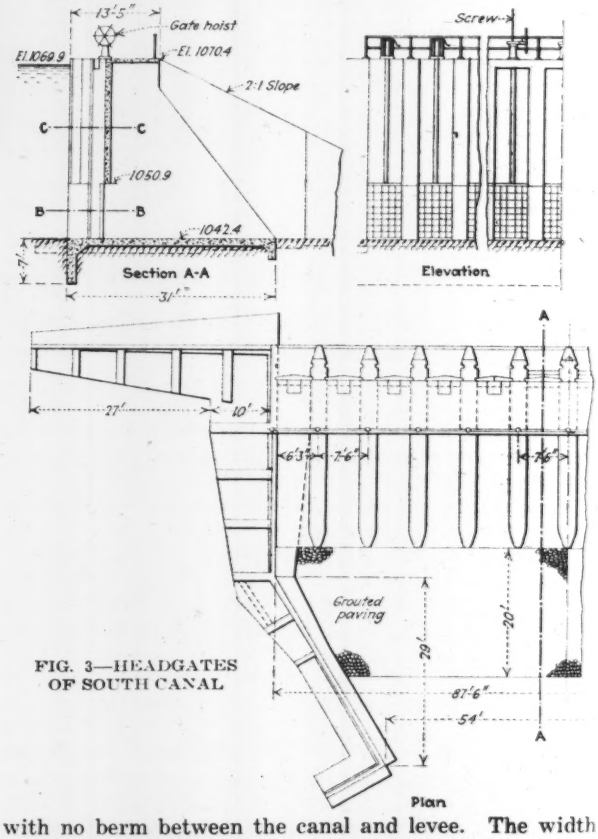


FIG. 3—HEADGATES OF SOUTH CANAL

with no berm between the canal and levee. The width of levee crown and the depth and width of canals vary with the size and slope of the canals. The maximum velocity adopted for water is 2.6 ft. per second, but usually the velocity was computed as 2.5 ft.; in some of the small laterals it is as low as 1 ft. per second, when the difference in elevation and general slope of the land was not sufficient to irrigate the lands properly.

South Side Canal—This canal, 33 miles long, extends from the diversion dam to Call Field, near Wichita Falls. Its capacity is 1,000 sec.-ft. from the headgates to Mile 15, the junction with the North Side canal; 500 sec.-ft. to Mile 18, the junction with the Holliday canal, and 125 to 75 sec.-ft. to the end.

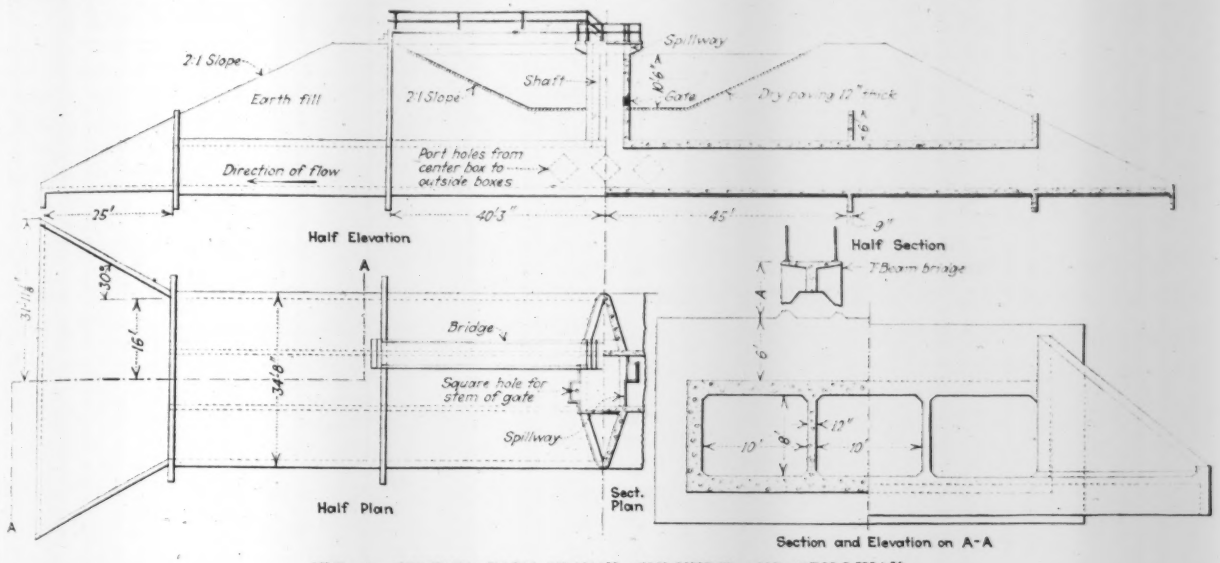


FIG. 4—COMBINATION FLUME, CULVERT AND SPILLWAY

The canal headgate works at the diversion dam are built of reinforced concrete as a part of the dam spillway structure, and are located in a saddle about 50 ft. from the south end of the dam. As shown in Fig. 3, there are twelve cast-iron gates 5x8½ ft., operated with a rack and pinion lift, to pass the water into the South Side canal. Radial gates are used in combination with flashboards and metal gates for canal checks. The main canal culverts are built of reinforced concrete. For the headgates of the laterals, there are reinforced-concrete headwalls with vitrified clay pipe laid through the levees and fitted with metal gates. Ordinary highway and farm bridges have concrete piers with timber superstructure, but the major highway bridges are of reinforced-concrete slab design. Where bridge piers were placed in the canal, the canal section is widened slightly for uniform capacity.

At two points on this canal there is a combination triple-box culvert, wasteway and spillway. One of these is shown in Fig. 4. The spillway consists of a tower in the center of the canal, with overpour through a well into the triple 8x10-ft. box culvert below. One 4x5-ft. wasteway gate is installed on each side of the well, for draining the canal when desired. A small footbridge leads from the levee to the top of the tower.

High fills were built across the valley at each of these structures, averaging 8 ft. below the bottom of the canal. The material in these fills consists of good clay, and was placed in 12-in. layers rolled with a 10-ton road roller. A wasteway built in combination with a culvert at Mile 18 consists of two 4x4-ft. metal gates built into a box on top of the double 4x4-ft. box culvert, through which to drain the water from the canal into the culvert.

A combination check and headgate and spillway structure at the junction of the South Side and North Side canals is of reinforced concrete, with radial gates in combination with metal gates for check and headgates. Small lateral headgates with metal gates are placed in the walls of the structure above the check and headgates, the water being carried through the levees in vitrified clay pipe to small laterals on each side of the North Side canal. There is a 4-ft. drop into the North Side canal, built in combination with the headgate structure. The radial gates in both the check and headgates are built one foot below high water line, in order that they may act as spillways for the South Side canal above the structures, and prevent the canal from overflowing the levees.

North Side Canal—This canal, 29 miles long, extends from its junction with the South Side canal, across the Wichita River and along the foot of the hills north of

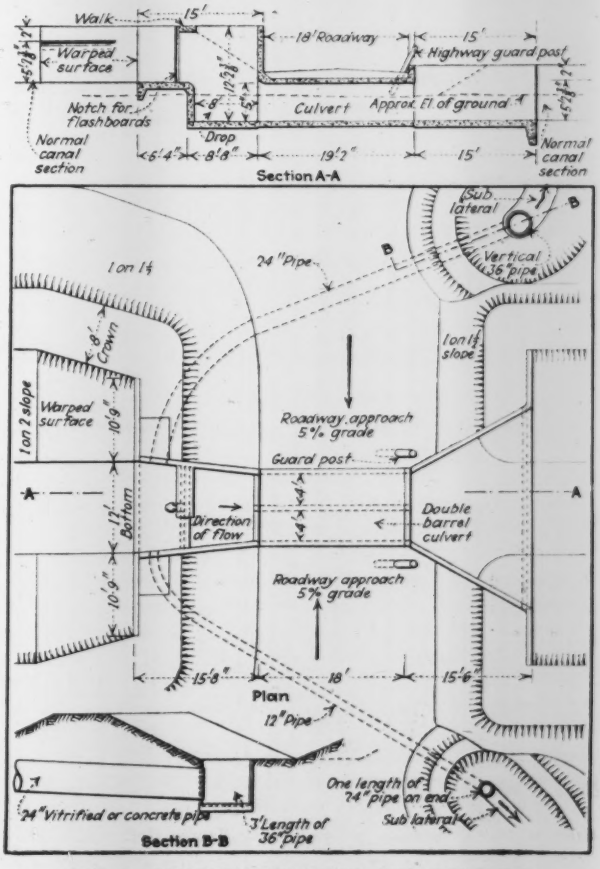


FIG. 5—COMBINATION DROP AND CULVERT

Fig. 5, is a combination drop, road siphon, check and lateral headgate. Metal headgates are put in the walls of the structure, where required, above the checks, the lateral being carried through the levees in concrete

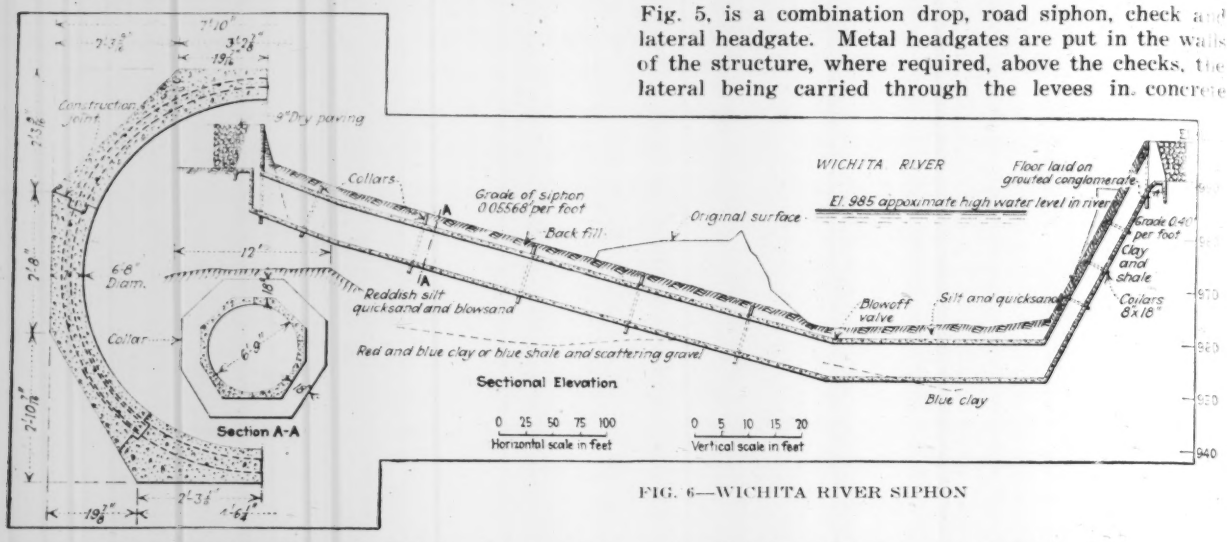


FIG. 6—WICHITA RIVER SIPHON

the river to the Wichita-Clay county line. Its capacity begins at 300 sec.-ft. and reduces to 90 sec.-ft. at the lower end. Combination structures are frequent on this canal; drops, checks, road siphons, lateral headgates and drainage structures being combined into a single structure where possible. An example, shown in pipe. Flashboard checks are provided at the upper ends of all such structures. Below the check, drops are placed into box road siphons. The entrance to the siphon is sufficiently large to allow for the fall, and there is enough head after the fall to secure the desired velocity through the siphon. Several of the road

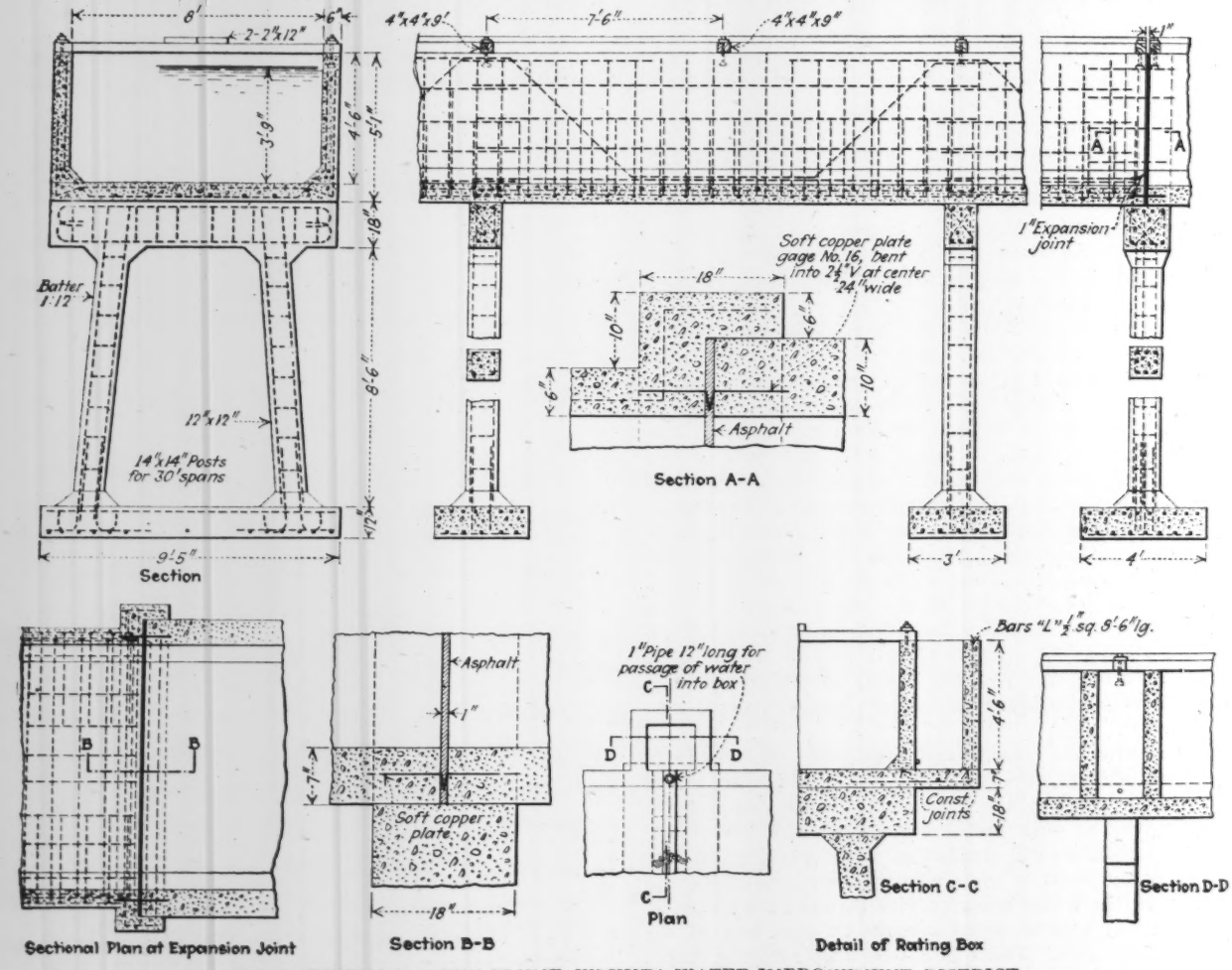


FIG. 7—BUFFALO CREEK FLUME, WICHITA WATER IMPROVEMENT DISTRICT

siphons were built low enough to pass surface drainage over the barrel, and thereby avoid culverts and long outfall ditches.

Siphon and Flume—The Wichita River is crossed with a reinforced-concrete siphon 80 in. in diameter and 825 ft. long, with a maximum head of 45 ft. The top of the barrel in the river section is about 3 ft. below low-water level. At full capacity, the velocity through the siphon is 8 ft. per second. A 10-in. blow-off valve is provided in the river channel. This siphon, Fig. 6,

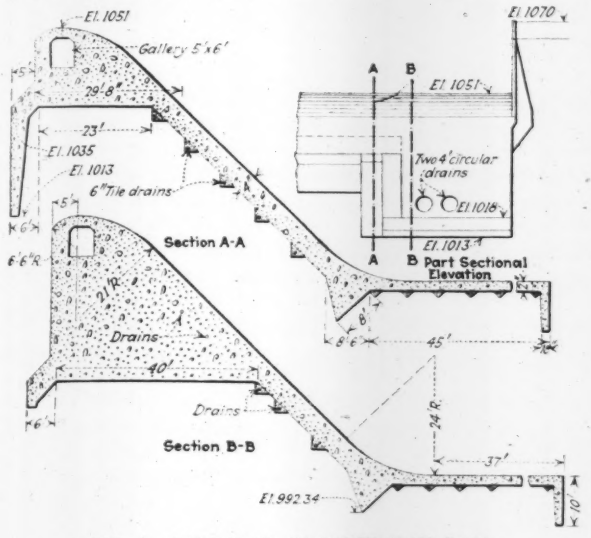


FIG. 8—SPILLWAY IN DIVERSION DAM

is of octagonal section on the outside, built in four sections for the bottom, sides and top.

At the Buffalo Creek crossing, a reinforced-concrete flume is built, Fig. 7, consisting of an 8x4½-ft. trough on reinforced-concrete piers and headwalls. Wing walls at each end tie the structure into the high fill approaches. At these headwalls the embankment was puddled and 6-in. tile drains were placed on the footings to carry away seepage water. The canal section is paved for a distance of 45 ft. from the headwalls at each end of the flume. Rating boxes are built in the sides of the flume. This flume, 240 ft. long, has three 30-ft. spans at the creek, flanked on each side by five 15-ft. spans. Its floor is about 10 ft. above the bed of the creek and 4 ft. above the land on each side.

A typical wasteway consists of concrete headwalls with a 2½x4-ft. metal gate. The water is carried through the levee and to the bottom of the stream through a concrete pipe. Another wasteway and spillway is made by lowering the levee to the high-water line and constructing concrete walls at each end and a concrete drop to the creek bed. A sluiceway is provided through the levee with a 3-ft. wooden gate for wasteway.

Distribution System—There are about 125 miles of small lateral ditches, of capacity ranging from 70 to 5 sec.-ft., the size depending upon the amount of land to be served. Creosoted wooden bridges are used for farm and highway overcrossings. Concrete pipe siphons for undercrossings, with concrete headwalls and a flashboard check at the upper end, are placed usually below the road ditches, in order that surface drainage may pass over the barrel. Concrete pipe with concrete headwalls is used for the smaller culverts.

Headgates, checks, wasteways and delivery gates for the laterals are of creosoted lumber, equipped with wooden gates and flashboards. Drops are of reinforced concrete, but where only about 1 ft. drop is required, the ordinary check is substituted, placing the floor at the same elevation as the bottom of the canal below the drop, and nailing two 6-in. flashboards in place. There are several metal flumes constructed upon creosoted lumber substructure and concrete foundations, and having concrete portals at the ends.

Diversion Dam Spillway—In the earth-fill diversion dam, the spillway is at the south end, against the hill. A gravity type dam forms the crest of the spillway, Fig. 8, which, with a concrete paved slope, leads into a deep pool, the bottom of which is 16 ft. below the river channel and 51 ft. below the spillway crest.

This spillway is 308 ft. long, has 19 ft. of freeboard, and rests on a soft shale foundation. It varies in height from 11 to 33 ft. and is protected by a cutoff wall on the upstream side, 10 to 20 ft. in depth. A concrete slab 4 ft. thick is laid on the shale with a 1 on 1 slope from the toe of the dam proper to the bottom of the pool, and extending horizontally a distance of 45 ft., ending in a cutoff wall 10 ft. deep in hard shale.

With the spillway placed on the side of the hill instead of across the channel it was necessary to excavate extensive inlet and outlet approaches. The inlet channel was excavated to a depth of 10 ft. below crest of spillway and 1 ft. below the floor of the headgates. Under the slab and pool paving are 6-in. tile drains 10 ft. c. to c. Two 48-in. circular gate valves are placed 4 ft. above the channel level in the main section of the spillway to carry the normal flow of the stream. These are operated from a tunnel which passes through the full length of the gravity section.

Engineers and Contractors—R. A. Thompson was chief engineer of the District; O. N. Floyd, assistant chief engineer; P. A. Welty, locating and resident engineer for the canal system; T. C. Shuler, resident engineer for the diversion dam. The writer was office engineer. The Morgan Engineering Co., Memphis, Tenn., was consulting engineer, and the Callahan Construction Co., Dallas, Texas, had the general contract.

Decision Against Non-Registered Architects

Practicing under the title of architect but without a license has been held by a Detroit court to be a violation of state law. The case was instituted through the prosecuting attorney's office by the Michigan Society of Architects. The defendant pleaded that he had made application to take the state examination, but had not received notification of the time it was to be held. The judge withheld his decision pending the defendant's taking the examination; the defendant failed to pass after which the judge found him guilty. The penalty according to law is a fine of not to exceed $100 as well as a jail sentence. In this case sentence was suspended since it was the first tried under the act and had for its purpose the establishment of a precedent for future cases. The Michigan Society of Architects for some time has been collecting photographic and documentary evidence covering practically every violation. Attorneys have been employed to take up the cases one by one until the situation has been remedied. Lancelot Sukert is chairman of the committee on registration and prosecution, also a member of a similar committee of the Detroit chapter, American Institute of Architects.

Hurricane Effects on Buildings at Hollywood, Florida

Construction Weaknesses Evident Here on Minor Structures—Roof and Wall Failures Due to Lack of Anchoring

By George M. Beerbower
Architect, Hollywood, Florida

IMMEDIATELY after the destructive hurricane of Sept. 18, the writer was appointed to make a survey of the structural condition of damaged buildings in the two sections of Hollywood. They included the business zone and the best quarter of the residential zone. This work yielded a number of valuable conclusions, which should be of interest to all who plan and construct buildings. The most general conclusion is that the damage cannot be explained simply by ascribing it to force of the elements, since weak construction played a very obvious part in the total. The wind pressure found weak points of most diversified kind, presenting a number of valuable lessons.

Roofing Weaknesses—Roofing of every kind suffered damage. Hollywood had many Spanish tile roofs and these suffered only little damage where they were properly cemented; but where they were left with openings for the wind to get under the effect was to make the destruction extensive. "Built-up" roofs were generally of only three or four-ply thickness, and in many cases were merely nailed. The nails, of course, held the felt only under the head of the nail, and little wind pressure under the felt was needed to tear the roofing around the nail. Other roofs of this type relied upon tar to cement the felt to the roof boards, but much of this roofing appears to have been put on damp boards, or the tar became cold before the felt was applied, and the bond was weak. In no case was the felt loaded with gravel, which would serve to hold its full area in contact with the roof boards. Thus, the roof covering as a whole was very weak, and was bound to go as soon as the wind obtained entrance under the edges. Many of the roofs had no parapet at the rear, and the felt ended flush with the roof boards, depending upon the tar cement to make the edge airtight; this it failed to do. At the parapets, there being no need in southern Florida's climate to provide against snow, the edge of the roofing was turned up only a short distance and was pasted to the parapet instead of being built into the walls or having copper cap flashing built in. These details invited entrance of the wind.

In Hollywood, wood shingles were prohibited because of fire risk. Nearly all pitched roofs were covered with one of the various kinds of crushed slate surface, "strip shingles" or roll felt. The strip shingles were most commonly torn off. The roll felt was cemented at all edges of the roof, flush with the edges of the sheathing, and in the courses was nailed at the upper edge and held at the lower edge by cementing on top of the course below. The material had no plain margin (strip along the edge with stone omitted, to provide for bonding with the next course) and the crushed slate from the top surface of the lower width in many cases was found to be stuck to the cement-coating under side of the upper strip. This would seem to indicate that better bond would have been obtained with plain margins or else that the cement was not hot enough or was not used liberally enough. The weakness of the cement bond at this point is further shown by the fact that in no case did the detached pieces of roofing show portions of two widths still cemented together.

With regard to observations of this kind, it should be remarked that the Sept. 18 hurricane undoubtedly produced an unusually high wind pressure, but the pressure can hardly be considered so greatly in excess of that which other sections of the country may experience as to make the conclusions inapplicable in other sections even where storms are of different type.

Walls—With respect to wall construction, one of the worst examples was presented in the Professional Building. This structure was about 120 ft. long, three stories high, fitted with a high parapet. The structure is a reinforced skeleton with concrete block curtain walls. Columns and lintels, as well as curtain walls, were only 8 in. thick, from the foundation up, and the entire west side, which fell, showed no legitimate wall anchor. The wind that wrecked this building came from the east, and the east wall was held by the wind against many well-braced wooden partitions; but the west wall, having no wind to hold it in place, was blown down, the larger part of it falling all the way to the foundations.

In general, it may be said that in no case where a wall was wrecked could any wall anchors be discovered. Contractors said that dealers did not carry them in stock, and there were no blacksmiths to make them.

A very bad case of destruction in the residential zone was that of the Methodist Church. The rear part of this structure, containing large rooms for social functions, and most of the front vestibules stood throughout the storm, showing the same degree of resistance as did the properly constructed residences in the vicinity. But the sidewalls of the church both fell to the south, and in fact this occurred before the storm had done any other damage of consequence. These walls were of reinforced concrete skeleton construction with interlocking terra cotta tile curtain walls. The columns were 14 in. thick and about 30 ft. high. Adequate buttresses would undoubtedly have saved these walls.

The roof trusses of this church spanned from column to column, but were not held down by anchors. Purlins were attached to the trusses with from two to four 8d. nails each. The inevitable result was that when the wind pressure exceeded the attraction of gravitation the entire roof, framing and all, flew far away.

Many apartment garages existed in the zone examined by the writer. Not one of these stood. The structures were of hollow tile, concrete block, or stucco on wood, but having only three sides in the lower story, and no lateral bracing, they collapsed under wind pressure.

Flimsy construction was also apparent in large extent in dwelling-house construction. Many dwellings were built of wood frame covered with stucco on steel fabric with paper woven in. Unless the frame had adequate bracing, there was neither rigidity nor weight in the structure. Clapboarded houses were also weak; sheathing was seldom used, and the many large openings provided for air circulation gave little chance for bracing.

The possibility of destructive winds may be said to exist everywhere in the country, not merely in southern Florida. Accordingly, the lessons learned from the Florida storm effects should serve as a warning to builders regardless of their geographical location.

Tropical Hurricane on Oct. 20 Hits Western Cuba

Two-Day Advance Warning Given—Aerometers Blow Away After Recording 96-Mile Wind—Sugar Cane Damaged—Harbor of Havana Suffers Heavily—Water Supply Cut Off by Break in Aqueduct

By I. W. McConnell
Vice-President, Dwight P. Robinson & Co., Inc., New York City
AND
A. J. Hammond
Chief Engineer, Mellon-Stuart Co., Chicago, Ill.

[The following article is sent by the authors from Havana, where they have gone in the interests of their respective companies who, with others, have put in a group bid on Cuba's projected extensive public-works program.—Editor.]

THE western portion of Cuba was greatly damaged on Oct. 20 by a tropical hurricane which originated in the Caribbean Sea nearly 1,000 miles southwest of Cuba and continued its destructive course northeastward until it was dissipated along the northerly margin of the Gulf Stream in the latitude of northern Florida.

The hurricane was announced as forming as early as the morning of Oct. 18, the Weather Bureau at Washington and the National Observatory in Cuba stating it was gathering force and would probably travel toward Cuba. On Oct. 19 the warnings were definitely given for Havana and western Cuba. Storm signals were displayed along the coast and information given that the blow would begin after midnight on the 19th. Dwellers in Havana began active preparation on the 19th and by midnight the town was fairly well closed up.

The afternoon of the 19th up until midnight was rainy with a steady increase in precipitation and wind velocity until after 2 a.m. of the morning of the 20th. Sometime between 2 and 5 a.m. the wind rose to velocities of hurricane proportions. In this period the wind was from the east. After five o'clock the wind shifted to the northward. After 10 a.m. there came a sudden shift to north and northwest. Its greatest strength came between 10 and 11 a.m. although an immense amount of destruction had occurred before 9 a.m. There were no electrical disturbances, but the rain fell in torrents, was picked up and thrown with violence before the wind, cutting off all view of objects farther away than a few yards. The ocean was whipped into enormous waves which rolled over the sea wall and converted the lower streets of the city into canals of surging water.

Of Usual Cyclonic Type—From subsequent observation of the effects of the storm it is apparent that it was of the usual cyclonic type and that the center traveled northeastward in a path south and east of Havana. In the vicinity of Havana and to the westward trees were laid down to the west and south. At Guines, which is about 30 miles southeast of Havana trees were laid down to the north and east. The observed direction of the wind during the storm and the position of trees blown down indicate that the northwest quadrant of the storm and a portion of the southwest quadrant passed over Havana, that the center passed within 15 miles of Havana to the southeastward.

The aerometers at the National Observatory blew away when the wind reached 96 miles per hour, and before the heaviest blow occurred after 10 a.m. By 2 p.m. the wind had receded to gusty squalls with showers of rain. At 9 p.m. the moon was shining in a practically clear sky.

Destruction General — Immediately following the storm the streets and roads presented an appearance of great destruction. Nearly every tree in the parks and shaded avenues had been laid down and in many cases uprooted. Walks and streets were badly blocked by trees and the debris from damaged buildings. The tendency of the storm appeared to be to form a pressure within the buildings since walls, plate glass windows, shutters, doors, etc., were usually thrown outward into the street. In the country where the roads are bordered largely by rows of trees, travel was difficult even for a horseman or a pedestrian and impossible for wheeled vehicles. Trees which were not uprooted or overturned were usually stripped of limbs, foliage was stripped from ornamental plants, fruit trees were broken and torn up, forage crops were flattened and stripped, fields of beans were so torn and battered as to be worthless. On the hills about Havana which are covered with forest growth the leaves are as brown as in October in the north. The whole landscape has been converted from an expanse of dark green to one of dead brown from which emerge cliffs, boulders and other topographic configurations never before visible to people who have been familiar with this section for many years.

Sugar, being the greatest crop of Cuba, naturally came in for a great deal of attention. It is said that there were forty sugar mills in the path of the hurricane. Practically every mill has received some damage. In the main, however, the damage consists of collapsed walls, wrecked roofs or small buildings destroyed. Machinery has usually escaped material damage and the light construction employed in sugar mill buildings will permit restoration by the operating forces of the mills which are now in the non-operating season.

The destruction in the cane fields is perhaps the most serious loss on the Island. Many fields give the appearance to a non-expert eye of being 100 per cent flattened out and so tangled and twisted as to preclude the possibility of harvest by any process other than that of reclaiming one stalk at a time from the tangled mat. The extent to which root growth has been torn up cannot be accurately judged as yet. Competent observers say that the situation will reveal itself in ten days or two weeks, and that the damages may run as low as 20 or as high as 50 per cent. New cane set for next year is not damaged.

Garden crops, bananas, forage, nursery crops, etc., within the path of the storm are pretty thoroughly wiped out. The injury to the tobacco crop is not so great since the new plants are not yet in the fields.

The small houses of country dwellers, usually of light frame, frequently with palm thatch roof, show examples of complete destruction, alongside of practically complete survival. Why the same storm will lift up one

small house and scatter it about and leave its neighbor practically intact is not revealed by the observations made.

Damage to Buildings—Some of the interesting effects of the hurricane may be had from a comparison of the damage to the buildings. The older buildings in Havana are of native stone only three or four stories in height, and of solid wall construction. Only one of this type of building was observed wrecked; this was located in a corner on the Malecon facing the ocean and the outside walls fell into the street.

In the Sevilla Biltmore one or two inside partitions were blown down and several windows were blown in. Outside doors in the large openings of the grill had been heavily barred with strong timber, yet the wind blew one of these big doors in, and holes were dug into the marble floor to provide a footing for braces, before the doors could be held.

The wind got under the heavy tile roof of a large building on Central Park and carried the heavy tile into the street. However, a scaffolding of the usual light timber construction about four stories high across the street remained without damage. A steel concrete-distributing tower, with its complement of concrete troughs, swayed back and forth but weathered the storm.

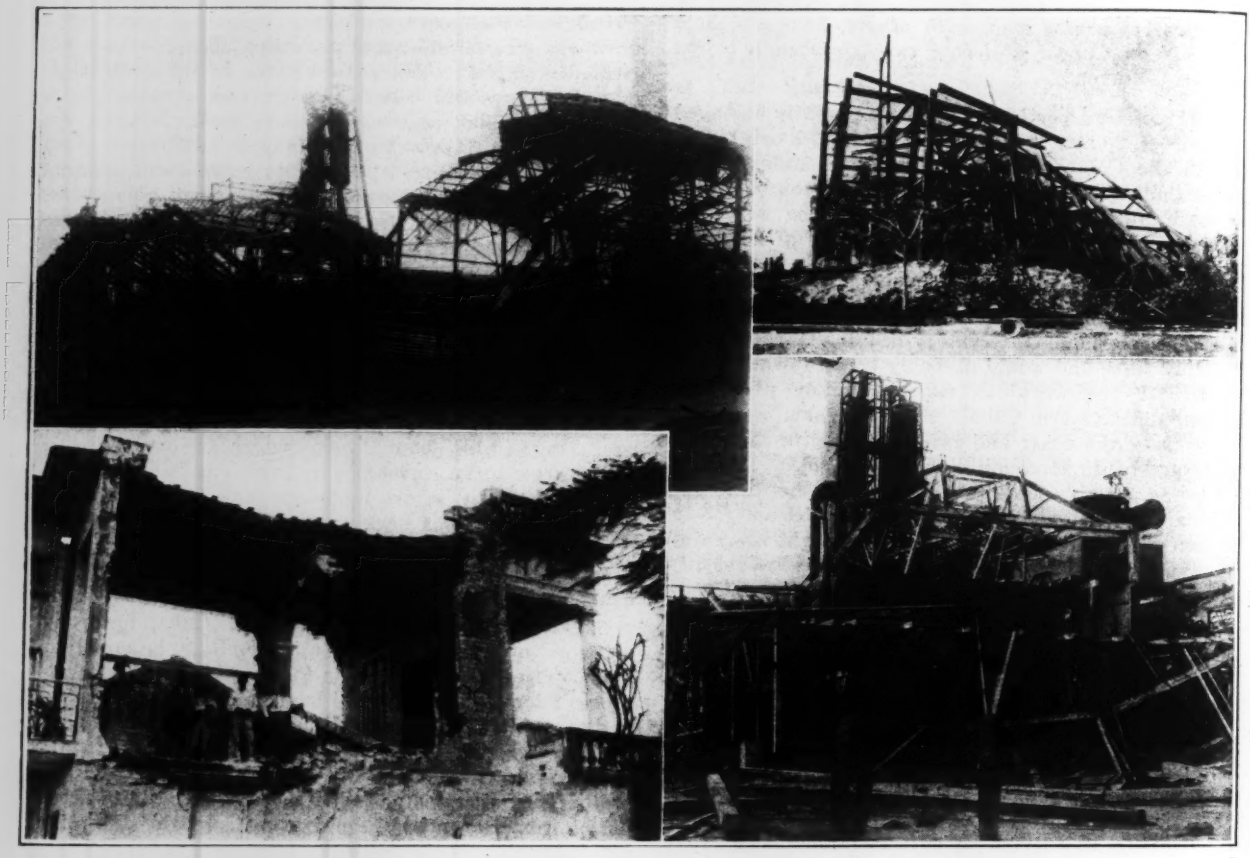
The damage to buildings in the central or business section of Havana only appears in the roof and parapet wall portions and windows. Some few flat roofs caved in from water pressure, as an exceedingly heavy rain accompanied the storm.

In the suburbs where the dwellings were of lightest construction, often of a thin layer of tile, the outer walls and partitions were frequently blown down but in only a few cases was there complete destruction.

Aqueduct Broken—The morning of the storm a break occurred in the aqueduct which provides the complete public water supply for Havana, resulting in such a reduced flow that the supply was cut off generally throughout the city. The aqueduct was constructed some 50 years ago, of horse-shoe shape, with an invert of hydraulic lime concrete and an arch of one ring of native brick on end using hydraulic lime mortar. The bricks are unusually large red brick of good quality giving about a 10-in. wall with the outside mortar cover.

The break occurred several miles from the city where the aqueduct is above the natural ground surface and where it is adjacent to a highway. The heavy rainfall caused a pressure of water to be exerted from the road side and the brick section for about 300 ft. was washed off its base, the major portion of the flow being diverted to the adjacent low fields and only a small stream in the curved invert continuing to the city.

The Department of Public Works immediately ordered repairs, sending cement, sand and stone, but temporary measures were promptly taken to construct a timber flume in line with the aqueduct; the engineers of the Department of Public Works cleverly designed the temporary flume in the shape of a cofferdam, inside walls at the inside of the spring line of the arch and the outer



STRUCTURAL DAMAGE WROUGHT BY CUBAN HURRICANE OF OCT. 20

Upper left: Toledo sugar mill at Mavianao just outside of Havana. Upper right: Steel frame of 4-story apartment house under construction in Havana. Lower left: What is left of a 2-story residence. Lower right: "La Julia" sugar mill, Havana Province, typical of the industrial damage done by the storm in the Havana region.

line, outside the masonry, so a temporary flow of perhaps 50,000,000 gal. could be obtained and continued, while the permanent masonry work was being placed. Great credit is due the Cuban engineers for the design of this repair job and the prompt execution of the plan.

Harbor Losses Severe—One of the most severe cases of loss will be in the harbor. A launch trip around the entire harbor of Havana on Oct. 24 disclosed twenty or thirty vessels sunk and several large ones on the rocks, and the destruction extended entirely around the harbor, no section being free; whether this loss was due to wind action alone or wave action alone or a combination it is difficult to say. Immediately after the passing of the severest portion of the storm the writers visited La Punta, and got as close to the sea wall as possible; waves were rolling into the throat of the harbor at Morro Castle 20 ft. high, just a few inches below the sea wall, and the force of this wave action caused boats in the harbor to slip anchor and roam at will during the storm. Some of the older wharves were injured, but recently constructed ones were not damaged.

The eagle on the monument to the Maine was blown down to the ground and landed right side up facing in the direction of the wind, facing the ocean, and remained so during the storm. A comparatively new coal unloader at a dock on the north side of the harbor was blown down and the steel was twisted and bent, this unloader projected into the harbor and would be subject to wave as well as wind action.

Emergency Repairs—Prompt action was also taken by the Sanitary Department of the city to warn all the inhabitants to boil their water and tanks were immediately put into service distributing water to the residential sections of the city where there was no elevated tank supply. Extraordinary precautions were taken by the Department of Sanitation to prevent a typhoid outbreak.

Electrical services of all kinds were broken off. Overhead systems were blown down and left in a mass of tangled wires. About 8 p.m. on the night of the storm partial light service was given in the hotel district, power service was resumed on Oct. 21 and on the 26th a general resumption of electric and street car service had taken place. The Havana Electric Co. met the emergency in a competent way and contributed greatly to the convenience and comfort of the people by its energetic handling of the problem of restoration.

Emergency work carried out by the Cuban government reflects great credit upon President Machado, Secretary of Public Works Carlos Miguel de Cespedes and the police. The great burden of clearing up streets and roads for travel and of restoring water supply and sewerage fell upon Secretary of Public Works Cespedes. As soon as the storm would permit, his organization began their numerous and widely scattered tasks. Business was resumed in Havana on the afternoon of Oct. 21 and by the morning of the 23rd there was little street obstruction of a serious character. In the principal hotels of the city there was a partial water supply the day after the storm with an augmenting volume since. Complete service was expected by Oct. 26. The country roads were opened up to the suburbs on Oct. 21 and to such remote places as Matanzas, Batabano and Guines by Oct. 24.

In its respect for the warnings of the hurricane given out and in its handling of the emergency following the storm, Cuba and the city of Havana have set an example which may well be followed by other communities.

Letters to the Editor

A FORUM FOR DISCUSSION OF VIEWS OF ENGINEERS AND CONTRACTORS

In Defense of Railway Engineering

Sir—I have read the editorial in your Sept. 23, 1926, issue, p. 489, entitled "Railway Recruits" which seems to me to deserve a reply.

The details of railroad maintenance and operation and of railroad management are so large that each branch of the service might be called a specialty in itself. Certainly there is no branch of engineering which gives the broad experience furnished by a large railroad. There are opportunities for civil, mechanical, and electrical engineers, and the activities of the railway are so inter-related that an alert engineer has opportunities of contact with other branches of the service working toward the same end that are encountered in only a few other lines of human endeavor. An engineer's experience on a railway is broad both as to actual experience in the course of the individual work of the engineer and as to opportunity for study and observation of other branches of engineering with which the various ramifications of the railway service bring him in contact.

Comment is made as to the reluctance of railway companies to change established practices. A railway is a large institution. It is composed both of physical plant and of the men who constitute its organization. Its physical plant must meet the demands of a hard and exacting service. As a large body, all of the numerous items of which are in continuous service, any change must be thought out and thoroughly tested before adoption. Materials and methods in use have usually been evolved from long experience, but, even so, I think that the railways are progressive. So far as concerns construction, there is usually no reluctance to change when the change really represents improvement, and as new practices are evolved and new demands arise there are improvements made in more efficient and heavier rolling stock, bridges, track material, etc. But these changes cannot be made without sufficient experimentation and knowledge to insure the continuous and smooth operation of the transportation plant.

The fact that engineering on a railway is a means to an end namely, the efficient and economical production of transportation, does not tend to narrowness but rather has a broadening effect, for in the last analysis all engineering work is performed for a purpose and railway engineering in its design and planning always has the purpose in mind and works to that end. I cannot agree, that there is less tendency to engineering independence of thought on a railway than in other engineering operations. On the other hand the railway engineer generally has a wide scope in the selection of details of construction both as to design and methods, and selection of material for important items in the physical structure of the line.

Reference is made to railway work partaking of the nature of a guild. Railway engineering is part of a broad service the ultimate aim of which is to furnish transportation to fit the needs of the people in all their various requirements. Among the most desired aims of a railway, or any other great organization, industrial, military or public, are the intangible things called esprit de corps and morale. These can only be obtained by each component part of a large organization filling its vital and necessary place, the functions of which are co-ordinated with and become a part of the synchronized functions of the great whole. The railroad business is a complicated, technical business and the excellence of American railroading which is the aim and sometimes the accomplishment of the able and far seeing railroad officer is only attained by reason of the fact that it can attract to its service, train and keep therein for a lifetime, the ability of large numbers of alert and competent men.

Advancement in railroad service is not shut off from the able outsider, for all recruits, of course, come from the outside. It is, however, a technical business which must be learned within the business and superimposed upon the technical training of any college man. A college training

will assist men in railroad work, not only in the engineering branch but in all other branches, just as a trained mind will assist a young man in any life work he may undertake, but it will not take the place of brains, energy, alertness, good health, character, honor, and aggressiveness, which in addition to sufficient time for learning the complicated business are necessary for success. It is also true that competition within a railroad organization is keen, and that the college trained man must compete with the best untrained material, who have learned by hard experience and who work upward in spite of the lack of proper education and training. This very lack makes them more keen and worthy competitors of the trained young man who is apt to think that his qualifications of education and training entitle him to slightly less strenuous endeavor. In equality of opportunity there is no more democratic institution than a railway organization.

The statement is made that a railroad must accept what men come to it. This is no more the case in railway employment than in other industrial occupation. Railways have large numbers of applicants for work, but each employing officer carefully selects and weeds out his new men according to the fitness of the individual for the work.

I think that you are unduly severe in your discussion of the narrowing effect of railway engineering as a life work. Surely the successful railway executive is necessarily a broad man and considering the small proportion of trained engineers to the total railway employee the number of engineers who rise to executive office is great. This, of course, in a field where the road up is not closed to anyone, but where any man who has the brains, energy and character may aspire to the president's chair.

True, there is no royal road to advancement in the railway service but there is room in it for college men notwithstanding a possible academic theory to the contrary. These men however, must realize that success means work and ability to utilize opportunity and that no man who is unwilling to pass through the heat of the day can expect to win success therein. It is also true that to be a part of an earnest, honorable, hard working organization gives much satisfaction, and a lifetime spent in its service is well worth while.

The railways of the United States are private property devoted to the public service. The position of most railroad executives is exceedingly difficult as the interests of the private property must be and should be protected and the interest of the public in this private property is represented not only in the service requirements but in the requirements of the numerous local, state, and national regulatory bodies which must be met and satisfied. I submit that this arduous task is being well performed.

JOHN LANSDALE,
Valuation Engineer and Tax Commissioner,
Southern Pacific Lines.

Houston, Tex.,
Oct. 15, 1926.

Hopes Chemico-Mechanical Sewage Treatment Will Replace Biological

Sir—It has been very interesting to follow the divergent views of experts and others upon methods of sewage treatment. Some pens convey the idea that it is little short of criminal to use chemicals which may produce a large quantity of sludge, even if the liquid sewage, well separated, is converted into a reasonably innocuous and fairly non-putrefactive fluid. The writer holds no brief for any one system but thinks all should be considered impartially, whether proprietary or otherwise. He desires to present briefly some of the drawbacks to standard biological methods and some advantages of chemico-mechanical processes.

Separation of sewage into liquid and sludge is not a difficult matter. Screenings, sedimentation, either plain or aided by chemicals, or the aeration-biological-mechanical processes are each satisfactory and suitable under certain local conditions. The clarified liquid has been successfully treated by contact beds, sprinkling filters and simple sand filters, each in some particular locality, followed by sterilization with chlorine when thought necessary. But sludge disposal has not yet, in any of the standard processes, been fully satisfactory: Drying on filter beds, mixing with lime and pressing into cakes, or, if an extreme of dewatering is desired, centrifuging and drying in great ovens; all have merits under some circumstances, but are frequently attended with local nuisance and comparatively large expense. Other important factors, rarely mentioned in published articles, entering into nearly every generally accepted treatment process, are those of space occupied, with its capital value, and the seasonal inefficiency of all outdoor plants in all northern latitudes. The fact that certain patented processes have been tried out at various times and have not always proved successful, calls, not for condemnation, but the hope that further experiments will be made that shall yield future success. Not so many years ago, anything for water purification except slow sand filtration was poohpoohed by many otherwise sensible writers and even engineers; now, the man would be rash indeed who decried rapid mechanical processes, with large use of chemicals, the comparatively small space occupied and therefore easily roofed, all making for 12 months' efficient service.

For sewage treatment, the use of fresh lime has two good qualities: excellent coagulation, tending to rapid gathering of suspended and bacterial contents for ready settling, and caustic action which actually destroys much of the bacterial life. Common salt in solution, treated with properly applied electric current, is broken up into very powerful germicidal and sterilizing elements; an action not hindered by lime pre-separation of liquid from sludge. Electric current also breaks up water into component parts, of which nascent oxygen is a very active oxidizer, destroying organic matter present, according to its abundance and the quantity of current used. These three processes united in carefully conducted experiments have produced first-class results with moderate total costs in capital and operation.

Sludge produced by any of the mechanical separators, and by most of the biological processes, has some content of unchanged organic matter, ready for early or later putrefaction. That produced by fresh lime separation is still putrefactive, but well deferred in action. Both kinds of sludge have some agricultural value, when there is a market. Sludge treated with electricity and salt has no agricultural value, for, if properly applied, the putrefactive contents have virtually all been transposed into inorganic elements, therefore inert matter, readily dewatered, but only good for land filling. The agricultural value factor, is of but small moment in the larger cities; innocuous rapid disposal is of prime importance, and the smallest space that can be occupied for effective plants is an essential element.

Other chemicals and combinations of processes have been tried out, each with some degree of success—and failure, but on scanning the long list of unsatisfactory standard biological plants, one hopes that chemical-mechanical treatment systems will be further developed, and feels that attempts to that end should be encouraged. A recent mechanical-oxidation process, without use of even chemicals or electricity, except for motive power, has exhibited wonderfully successful results in a fair-sized experimental plant, but it will not be put on the market at present.

The engineer who presents any particular process as a panacea is not worthy the name; he must recommend that which seems best to suit local conditions, and should encourage all efforts to develop novel ideas, in the hope of finding something really useful.

LOUIS L. TRIBUS,
Consulting Engineer.

New York City,
Sept. 22, 1926.

Aurora Borealis's Influence on Magnetic Needle

Sir—An experience coming to me on Oct. 15 may be of interest to some of your readers. From the brilliant display of "northern lights" both on Oct. 14 and the night before, as well as the reports from telegraph and telephone operators, it was very apparent that we were in the midst of a violent electrical storm. While making a survey in which the use of the compass was involved I was attracted by the strange actions of the needle. This was brought to my attention first while on a line run a year ago, and marked by two stakes. The needle settled very closely to the bearing recorded a year previously, and at once, without apparent cause, changed 35 min. and soon after returned to its original bearing, although never quite steady. A little later, while on a line just run and marked with stakes and bearing noted, the needle again (without apparent cause) changed 1 deg. 30 min. and then returned (with constant wavering) to about its original position. Never, in my forty years' practice, have I seen such a demonstration.

JOHN H. BURLEIGH,
Civil Engineer.

Waterville, Me.,
Oct. 16, 1926.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Railway Building and Bridge Men Meet

Protecting Bridges from Blast and Gases—Pumps of Various Types Required—Treated Timber

Eight reports and three papers, covering a variety of subjects relative to railway structures, were presented at the annual meeting of the American Railway Bridge and Building Association, held at Richmond, Va., in October. The papers were on "Framing Bridge Timbers Before Treatment," by Earl Stimson, chief engineer of maintenance, Baltimore & Ohio R.R.; "Organization of Railway Painting Forces," by L. B. Allen, superintendent of maintenance, Chesapeake & Ohio R.R.; and "Reduction of Accidents to Maintenance Employees," by F. T. Carrow, chairman of the safety section, A.R.A.

PROTECTING BRIDGES FROM CORROSION

A report on painting as a protection of steel bridges from corrosion related largely to the economics of spray painting, with its advantages and disadvantages. Shop painting was shown to need careful inspection. Repainting is done at intervals of two to fifteen years on different roads, the shortest intervals being for structures near the sea coast. But most roads do the repainting when inspection shows it to be necessary and not according to a fixed schedule. Numerous special uses for bituminous and cement coatings were listed, the latter including the protection of the interior of water tanks. Another report dealt with the protection of overhead structures, both steel and concrete, from the blast action and corrosive gases from locomotives. With a headroom of the legal 22 ft., or more, the blast action is considered negligible so that maintenance of a good coat of paint is sufficient. With a headroom of less than 22 ft., the steel may be cased in concrete or tile, with blast plates placed over each track. Wooden blast plates are used by several railways, sometimes suspended below the structure; but steel and cast-iron plates are more general. In any case, the fastenings of these plates should not be exposed to the blast. In bridges, enginehouses, trainsheds and similar structures, care should be taken to avoid pockets where gases can accumulate.

Repairing concrete is a poor compensation for defective construction, according to the committee's report, and should rarely be needed, since it is now possible to make concrete that will meet severe conditions of service. That railroads consume most of the treated timber was shown in another report. About 70 per cent of the total is used for ties, but it is used also for trestles and buildings, being in some cases more economical than steel or concrete. The fire hazard is somewhat less than for untreated timber, the strength is not reduced and the same working stresses may be used in design.

Pumping equipment for such various purposes as locomotive water supply, fuel oil, fire protection, boiler washing, unwatering excavations and supplying stockyards, shops and stations, was reviewed in another report. Compressed air in bridge and building work is furnished mainly by portable gasoline-driven compressors, according to a report which listed various useful applications of pneumatic tools.

Election of officers resulted as follows: President, E. T. Howson, western editor of *Railway Age;* vice-presidents: F. C. Baluss, engineer of bridges, Duluth, Missabe & Northern Ry.; Maro Johnson, assistant engineer, Illinois Central R.R.; J. S. Huntoon, bridge engineer, Michigan Central R.R., and C. S. Heritage, bridge engineer, Kansas City Southern R.R. The secretary and assistant secretary, re-elected, are C. A. Lichty, Chicago & Northwestern Ry., and F. E. Weise, Chicago, Milwaukee & St. Paul Ry., both of Chicago. The 1927 meeting will be held at Minneapolis, Minn.

Engineering Fifty Years Ago

From *Engineering News*, November, 1876

THE work of dredging the Hudson River below Albany has been discontinued. The channel is still in a very bad condition, and the larger boats experience considerable difficulty in making the passage. The trouble is caused principally by barges which lie three or four days in one place, around which the sand collects. When they leave, small hillocks are left in the channel.

Wives of Norman Victims File Suits Against Goverment

Two suits against the federal government, each for $7,500, have been filed in the United State Court of the Western District of Tennessee by Mrs. Alice F. Bowser, widow of E. H. Bowser, and Mrs. Annette O. Shearer, widow of C. E. Shearer, two of the victims of the "Norman" disaster of May 8, 1925 (see *Engineering News-Record*, May 14, 1925, p. 827). Allegations of mismanagement, negligence and carelessness form the basis of the claims for damage. Fifteen other suits of like nature based on similar allegation are being prepared by Memphis attorneys.

Edward H. Bowser at the time of his death was superintendent of the timber department of the Illinois Central R.R. and Mr. Shearer was a consulting engineer.

Philadelphia Votes $5,000,000 to Sesqui Construction Debts

Philadelphia voters on Nov. 2 approved a "change of purpose" measure whereby $5,000,000 of a $7,500,000 loan authorized in 1916 and approved for use in 1923 is to be diverted to pay for the construction debts incurred by the sesquicentennial exposition. The other $2,500,000 is to be used for the construction of a bridge on the line of Henry Ave. over Wissahickon Creek and a viaduct on the line of Henry Ave. over the Reading tracks between Hunting Park and Roberts Aves.

The amount of this total indebtedness was originally authorized in May of 1916 and subsequently in September of 1923 was approved for use in the construction of a subway from the Delaware River bridge entrance, extending in Filbert St. to the Parkway, under the Parkway to 29th St., then either by elevated or subway to Roxborough.

Two More Bay Bridge Projects

In addition to the bridge projects submitted to the San Francisco Board of Supervisors noted in *Engineering News-Record*, Oct. 28, p. 720, two designs have been submitted by Charles Evan Fowler, consulting engineer of New York City. One of these proposes construction of three 2,000-ft. spans between Telegraph Hill and Goat Island and an approach from Goat Island to Oakland, and would provide for two rapid-transit tracks, two railway tracks and two automobile roadways. The estimated cost is $75,000,000. The bottom chord of this cantilever design is a cellular octagon 14 ft. in diameter. This plan was prepared in 1913 in comparison with a tunnel plan. The second design was presented at the hearing before the U. S. Engineers on Dec. 11, 1925, and was for a suspension bridge from Telegraph Hill to Goat Island, with a main span of 4,850 ft. and two side spans of 2,425 ft. The deck would carry two rapid-transit tracks and two automobile roadways. The estimated cost of this plan is $50,000,000 with eight steel wire cables and anchorages into the solid rock on either side. Besides the Oakland approach from Goat Island, there would be an elevated rapid-transit loop in San Francisco.

Missouri to Hold Conference on Water Purification

The second annual conference on water purification will be held at Jefferson, Mo., on Nov. 19 and 20 to discuss questions relating to the operation of treatment plants. Visits will be made to the new 3-m.g.d. filtration plant and the laboratory of the Missouri State Board of Health. W. Scott Johnson is secretary of the conference.

Ontario Hydro Gratified at New York's Power Plans

The plans of the New York State Water Power Commission for the development of the International reach of the St. Lawrence River, providing for a dam near Barnhart Island to develop the entire fall in the river between Lake Ontario and that point, have been received with favor in Ontario. The Hydro Electric Power Commission of Ontario has issued a statement in which gratification is expressed that the interests of the province have been fully recognized by the New York State Commission. The commission in its statement says:

"The New York State authorities sought by conference to facilitate the establishment of this basis of co-operation, which efforts had been heartily welcomed by the Hydro Electric Power Commission, and any steps that will further the development of the powers in the international stretch of the St. Lawrence River will receive the hearty support of the commission.

"The commission is pleased to note that our neighbors have moved in this matter and it is hoped that before long something definite will be decided upon, looking to the development of the St. Lawrence River powers. It is indeed gratifying to the commission to know that the interests of Ontario have been fully recognized and that the licensee will be called upon to confer with the Hydro Electric Power Commission with respect to the nature and plan of the development of the St. Lawrence River."

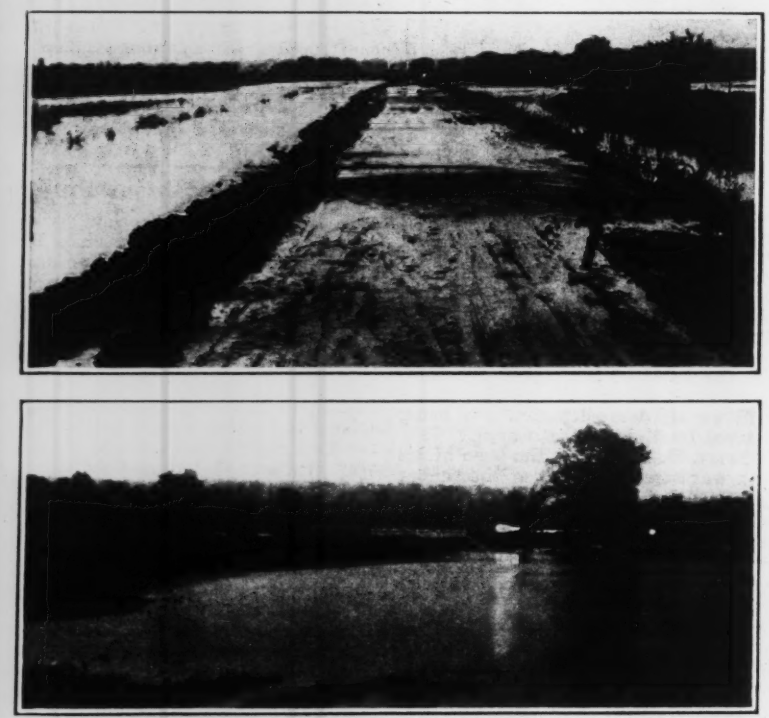
Flood Damage to State Roads in Missouri

Excessive Rainfall Causes Washouts of Bridge Abutments, Shoulders and Gravel Surfacing

Special Correspondence

The unusual rainfall during the past two months has resulted in many streams overflowing their banks in northern Missouri. These floods, in many instances, have caused washout of bridge abutments, culverts, shoulders of highway, and gravel surfacing. In a number of cases water has stood in the roadway too deep to permit the passing of automobile traffic. Besides the monetary loss due to washouts and caveins, much time has been lost by the traffic, and travelers have been greatly inconvenienced. Incomplete reports indicate that it will cost over $225,000 to make good the damage due to recent floods in north Missouri.

The structures damaged or roads flooded, have been those built by the counties for local needs, but which were being used by state highway traffic pending the construction of new structures and roads by the State Highway Department.



MISSOURI ROADS INUNDATED BY HEAVY FALL RAINS

Above: Water breaking through shoulder on left side of road; right half submerged by levee thrown up on road center line.

Below: Flooded conditions near Mineola; temporary road in foreground; new highway fill and bridge in background.

Mineola Damage

Special mention should be made of the flood at Mineola on U. S. Route 40, in Montgomery County, where the traffic was especially heavy and where great inconvenience followed its interruption. The creek bottom at this place is about a half mile wide and the old gravel road across it has in the past been subject to overflow about once a year. New bridges and a new fill well above high water are in the course of construction, but at the present time it is necessary for traffic to use the existing gravel road. The first overflow occurred on Sept. 4, the water reaching a depth of 4 or 5 ft. over the old road. Traffic was blocked for 15 hours from 6 a.m. until 9 p.m. This rise occurred just prior to Labor Day, and the holiday traffic being heavy, a real traffic jam developed with cars lined up for a mile back on each side of the creek. An effort was made by maintenance employees of the department to pull cars over the new fill, but the fill was soft and the pulling so difficult and slow that not many cars could be pulled through. It is estimated that about 2,500 cars were tied up in this jam. After the water had fallen so that cars could start through, the maintenance men acted as traffic officers and good order was maintained in unraveling and sending the traffic on its way. The second overflow occurred on Sept. 9, traffic on this occasion being stopped about three hours; the third overflow happened on Sept. 30, beginning about 2 p.m. and blocking traffic for twelve hours; and the fourth overflow was on Oct. 2 and blocked traffic for seven hours from 7 p.m. until 2 a.m. The traffic congestion experienced in the first overflow was avoided to a large extent in the other overflows by warning traffic of the conditions both at Fulton and Jonesburg, towns about 25 miles on either side of Mineola.

The accompanying photographs show conditions at time of flood.

Iowa to Hold Eighth Conference on Sewage Treatment

The eighth conference on sewage treatment under the auspices of the Engineering Extension Department of Iowa State College will be held at Ames, Nov. 16-18. The program of the conference will consist of lectures, demonstrations and roundtable discussions of every-day problems met in the care and operation of sewage-treatment plants. The talks and discussions making up the program will be informal and the various subjects will be treated in a non-technical manner. The program is being planned so that considerable time will be available for the consideration and discussion of individual problems of those in attendance.

As an indication of the general character of the program, the following list of topics is announced: The requirements for successful sewage-disposal plant operation, methods of sewage disposal, the role of bacteria in sewage disposal, septic tanks and their operation, Imhoff tanks and their operation, mechanical apparatus for clarifying sewage and digesting sludge, activated-sludge in sewage disposal, design and operation of intermittent sand filters and dosing apparatus, design and operation of trickling filters and dosing tanks, the causes of nuisances in sewage disposal, the treatment of creamery wastes, problem of industrial wastes, and the upkeep of plant and grounds.

Super-Highway Plan Contest for Chicago Environs Announced

The Metropolitan Super-Highway Association of Chicago has announced a contest which will close Dec. 15 for the submission of drawings and plans covering proposals to build wide roads in and around Chicago. The contest is conducted by the Super-Highway Association and DuPage County. The association itself is composed of public-spirited citizens of DuPage, Cook and Kane counties who are desirous of furthering the interest of super-highways in the metropolitan area. The first prize of the contest will be $1,000 in cash, the second, $300, and the third, $200.

The judges of the contest are D. H. Burnham, president, Chicago Regional Planning Association; Hugo E. Young, engineer, Chicago Planning Commission; Maj. R. F. Kelker, consulting engineer; George A. Quinlan, superintendent of highways for Cook County; Claude Hanson, superintendent of highways for Kane County; E. L. Gates, superintendent of highways for DuPage County, and G. N. Lamb, state district engineer. Further information on the contest can be secured by addressing the Metropolitan Super-Highway Association, 503 Burnham Building, Chicago, Ill.

Action Deferred on St. Lawrence Power Permit

The absence of a quorum put over until some time after Nov. 2 definite action by the New York State Water Power Commission on the permits pending before it for development of St. Lawrence River water power. At the hearing on Oct. 25 James W. Rickey, hydraulic engineer for the Aluminum Co. and Col. Hugh L. Cooper offered further evidence in relation to the feasibility of the development from an engineering standpoint. Colonel Cooper stressed the importance of the ice problems which will have to be met in construction and that the Commission should be certain that the party to whom a permit is issued will be able to overcome this problem.

A financial picture of how the development would be financed was presented by both of the applicants, American Super Power Co. and the Frontier Corporation.

Texas to Hold Water-Works Short School

The ninth short school of the Texas Section of the Southwest Water Works Texas, Jan. 24-30, 1927. H. H. Gowins, water commissioner of Dallas, is general chairman of arrangements; O. M. Bakke, superintendnt of filter plants, Dallas, is director of the school; and V. M. Ehlers, chief sanitary engineer of the Texas State Board of Health, secretary.

Instruction will be given in perfecting a safe and efficient water service, the relation of water to health, water aeration, and sewer problems. A number of speakers of national prominence in public health work are featured on the program.

Kelvin Medal Award Made

The award of the Kelvin Medal for 1926 was made at a meeting of the Institution of Civil Engineers of Great Britain held Oct. 26. The Kelvin Medal this year has been awarded to the Hon. Sir Charles A. Parsons, K.C.B., F.R.S., a member of the Institution of Civil Engineers. The Kelvin gold medal was established in 1914 as part of a memorial to the late Lord Kelvin and is awarded triennially by a standing committee consisting of the presidents of the principal representative British engineering institutions. It is awarded for pre-eminence in the branches of engineering with which Lord Kelvin's scientific work and researches were closely identified. The first award was made in 1920 to Dr. W. C. Unwin, F.R.S., and the second in 1923 to Elihu Thomson, an American.

St. Louis Opens Engineers Club

The new building of the Engineers Club of St. Louis, at 4359 Lindell Boulevard, was opened with appropriate ceremonies on Oct. 10.

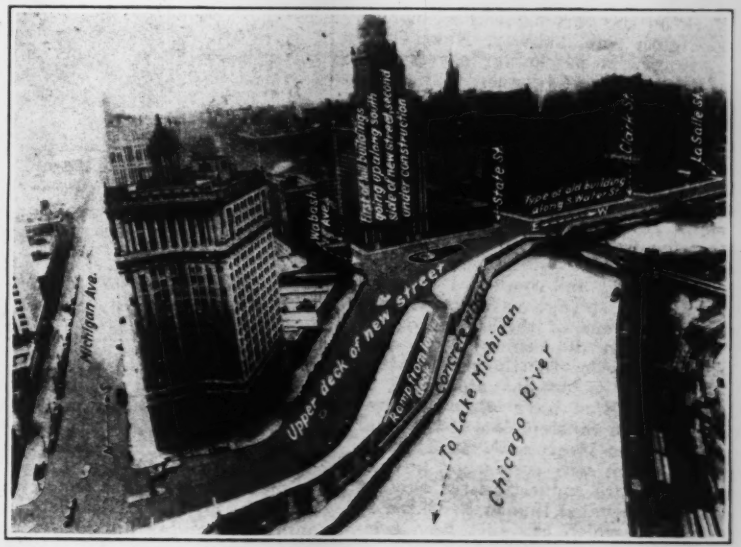
Chesapeake & Ohio to Build New Line in Ohio

Authority has been granted by the Interstate Commerce Commission for construction of a line of railroad from Gregg, on the Chesapeake & Ohio R.R., a distance of 63 miles through Pike, Ross, Pickaway, and Franklin Counties, Ohio, to a connection with the Hocking Valley, at or near Valley Crossing. The new line is to be known as the Chesapeake & Hocking Valley and was incorporated Sept. 24, 1926, by the Chesapeake & Ohio for building the proposed line. The latter company will advance funds for the construction to the extent of $12,500,000.

The line will be double-tracked and laid with 100-lb. rail. Its estimated cost is $12,371,188.

The Chesapeake & Hocking Valley must file application within 30 days of the issuance of construction authority for authority to issue capital stock. The Chesapeake & Ohio will be required to file its application to acquire control of this stock by purchase within 30 days after the date of the commission's approval of the issuance thereof.

DOUBLE-DECKING SOUTH WATER ST., CHICAGO, COMPLETED



WACKER DRIVE, the new double-deck concrete structure replacing old South Water St., Chicago, was opened for traffic with speeches and a parade on Oct. 21. There then remained some finishing and cleaning up but the main structure is finished. The design and structure and the construction methods were described in *Engineering News-Record*, Oct. 15 and 22, 1925, pp. 632 and 662. A notable feature of the work is that it has been accomplished at a cost considerably less than the engineers' estimate. The estimated time of construction has also been materially shortened. The total estimated quantities are: Excavation, 300,000 cu.yd., concrete 120,000 cu.yd., steel 9,300 tons, pavement 135,000 sq.yd., and piling 120,000 lin.ft. The estimated cost not including land damages is in round figures $10,000,000. The new double-deck South Water St. completes the Chicago City Plan quadrangle of wide streets, of which Canal St., Roosevelt Road and Michigan Ave., are the other sides, designed to allow traffic to skirt around instead of go through the down town business district. It has been built under the administration of Mayor William E. Dever with John J. Sloan, president, Board of Local Improvements, and T. A. Evans, engineer of design. We are indebted for the view shown to the Mid-Continent Construction Co., Frank J. Herlihy, president, Chicago.

Michigan Plans Memorial for Professor J. B. Davis

A committee has recently been appointed at the University of Michigan to erect a suitable memorial on the campus to Prof. Joseph Baker Davis, formerly of the university, who died in 1920. Clarence T. Johnston, professor of geodesy and surveying, is chairman and is receiving subscriptions in amounts not exceeding $5 for the purpose of a memorial. Any of Professor Davis' friends who wishes to have his name deposited in the memorial, whether or not he subscribes, should communicate with Professor Johnston at Ann Arbor.

To Regulate North River

The Quebec Streams Commission has decided to regulate the flow of the North River, in the Argenteuil district. The engineers have recommended the construction of a storage basin in the upper section of the river, which will assure for the whole year round a constant flow of water. Preliminary work will be started without delay and actual construction in the spring.

Subway Construction Progress

Work on the various sections of the new Eighth Ave. subway, New York City, ranges in percentage of completion from about 87 between 111th and 122nd Sts., to 16 per cent between 18th and 28th Sts. The following table gives the name of the contractor, per cent of value completed as of Sept. 30, and the average daily number of employees on each section.

Plans have been completed for finishing the first stage of the construction of the Coney Island yards which when completed and connected with the Coney Island storage yard and repair shop will be one of the largest yards of its kind in the country. To date the contract price for the construction work in the yards has amounted to $3,845,081. Bids have also been received for the construction of the final section of the Fourteenth St. Eastern subway which will consist of an elevated structure connecting the present Broadway elevated line in Brooklyn to the subway which has just been completed and whose construction was described in *Engineering News-Record*, July 8, 1926, p. 60.

Contractor	Limits of Contract	Per Cent of Value Done	Employees Average (Daily)
J. F. Cogan	Central Park W., 68th-79th Sts.	51	402
A. A. Johnson Corp.	Central Park W., 79th-89th Sts.	56	301
T. A. Gillispie Co.	Central Park W., 89th-101st Sts.	51	440
Rosenthal Eng. Contr. Co.	8th Ave.-Central Park W., 101st-111th Sts.	48	369
Heyman & Goodman Co.	8th Ave., 111th to 122nd Sts.	87	478
Rosoff Sub. Cons. Co.	St. Nicholas Ave., 122nd-132nd Sts.	74	431
George J. Atwell	St. Nicholas Ave., 132nd-141st Sts.	54	267
La Rocca Const. Corp.	St. Nicholas Ave., 142st-149th Sts.	13	273
Bethlehem Steel Co.	Steel—141st-149th Sts.	3.1	
Rodgers & Hagerty	St. Nicholas Ave., 149th-160th Sts.	52	481
Rodgers & Hagerty	St. Nicholas-Broadway, 160th-173rd Sts.	53	575
Rosenthal Eng. Contr. Co.	174th St. & Ft. Washington Ave.	99	0
Moranti & Raymond, Inc.	Broadway and 173rd St.	99	0
Michael Del Balso	Ft. Wasnington Ave., 174th-183rd Sts.	29	246
Silas B. Mason	Ft. Washington Ave.-183rd St.-Overlook Terrace	29	132
Moranti & Raymond, Inc.	8th Ave., Bank-18th Sts.	17	280
George H. Flinn	8th Ave., 18th-28th Sts.	16	355
Rosoff Subway Cons. Co.	8th Ave., 28th-38th Sts.	28	435
C. H. Locher	8th Ave., 38th-48th Sts.	21	529
Heyman & Goodman, Inc.	8th Ave., 48th-58th Sts.	19	597
Frederick L. Cranford, Inc.	8th Ave., Central Park West, 58th-68th Sts.	34	412
Arthur McMullen Co.	Broadway Overlook Terrace-Cummings St.	58	389
Silas B. Mason	Broadway-Cummings-211th Sts.	38	370
D. C. Serber	207th St., Broadway-10th Ave.	..	...

RANDOM LINES

Killing Time

Sir—The following quotation from *Mekeel's Weekly Stamp News* should be of interest to more than philatelists:

"Within a few days the two postcards . . . will be started around the world, in opposite directions. The first to circumnavigate the globe and arrive at the Collectors Club, N. Y. City, will be declared winner. The rules of the contest are simple, it being agreed that *the card traveling eastward, of course, shall be entitled to forty-eight hours handicap to make up for the difference in time—the eastbound card losing a day and the other gaining twenty-four hours.*"

I am proposing to the editor that they have Dr. Amundsen carry one around by the North Pole and the other one around by the South Pole, along the same longitudinal meridians, thus avoiding the necessity of a "handicap." The object of the race would be to see whether both postcards get back before the doctor starts. It is a matter of record that postcards sent to the North Pole on Amundsen's famous expedition, got back to the philatelists several months before his dirigible made the grand cruise across the top of the world.

H. R. F.

Two "Arch Dams"

Consolidation of St. Louis City and County Defeated

A proposal to consolidate the city and the county of St. Louis, Mo., was defeated by county voters outside the city at a special election on Oct. 26. The city vote was 62,625 for to 8,097 against consolidation but the county vote was only some 11,000 for to 21,000 against (6 out of 121 precincts missing). Cities in the county outside St. Louis are: Clayton, Kirkwood, Maplewood, Richmond Heights, University City and Webster Groves. Of these, Richmond Heights alone voted for consolidation (920 to 341).

Shawinigan Adds Another Unit

The Shawinigan Water and Power Co. has added another unit to its extensive system in the province of Quebec—the development at St. Narcisse, on the Batiscan River, which was officially opened on October 22.

The new development has an installed capacity of 22,000 hp., and the power generated is transmitted at 60,000 v. to Three Rivers, where it feeds into the Shawinigan system. The North Shore Power Co., a subsidiary of the Shawinigan Water and Power Co., developed power on this site as early as 1893, and transmitted it at 15,000 v. to Three Rivers, a distance of 17 miles.

Argentine Here to Study Hydro Plants and Flood Control

Argentina, having serious problems of flood control with which to deal, has sent Lorenzo Lépori, its director of hydrography, to the United States to acquire first-hand knowledge of the work which has been done in this country.

In addition Mr. Lépori is familiarizing himself with our hydro-electric and irrigation development. He will spend six months in this country. The water resources division of the U. S. Geological Survey is planning his trip so that he will be able to inspect the more important flood control works and hydro-electric developments.

A building in which to house a hydraulic laboratory now is being built at the University of La Plata. Mr. Lépori is gathering such data as he can in this country as a guide in the equipment of that institution.

While Buenos Aires soon is to have what is termed there a super-power steam plant, the capacity of which is to be 500,000 hp., the government realizes, Mr. Lépori states, that steps must be taken in the near future toward the development of the power resources of the Uruguay River. As Argentina has no coal and must import fuel from the United Kingdom or the United States, the promise of cheap power lies in hydro development. Because of the large capital outlay which this entails, the country thus far has not been able to bring about such a development. Stream gauging work and other studies have been in progress on the Uruguay river for many years.

San Diego Votes $2,000,000 for Water-Supply Dams

The electors of San Diego, Cal., voted favorably on a proposition Oct. 19 to issue bonds in the sum of $2,000,000 for the construction of two masonry dams both being part of the municipally-owned water system. One dam is at the Sutherland site on Santa Ysabel Creek and the other is at the San Vicente site on San Vicente Creek. The bonds carried by a vote of 16 to 1. The city engineer has been directed to prepare detail plans. A. P. Davis has been retained as consulting engineer.

Engineering Societies

Calendar

Annual Meetings

AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS, Washington, D. C.; Annual Convention, Pinehurst, N. C., Nov. 8-12, 1926.

AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS, St. Louis, Mo.; Annual Meeting, Washington, D. C., Nov. 8-12, 1926.

FIFTH ANNUAL ASPHALT PAVING CONFERENCE, AUSPICES ASPHALT ASSOCIATION, New York City, Washington, D. C., Nov. 8-12, 1926.

NATIONAL COUNCIL OF STATE BOARDS OF ENGINEERING EXAMINERS, Columbia, S. C.; Annual Convention, Philadelphia, Pa., Nov. 15-16, 1926.

HIGHWAY RESEARCH BOARD, OF NATIONAL RESEARCH COUNCIL, Washington, D. C.; Annual Meeting, Washington, D. C., Dec. 2 and 3, 1926.

AMERICAN ROAD BUILDERS ASSOCIATION, New York City; Annual Convention and Road Show, Chicago, Ill., Jan. 10-14, 1927.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; Annual Meeting, New York City, Jan. 19-21, 1927.

ASSOCIATED GENERAL CONTRACTORS, Washington, D. C.; Annual Convention, Asheville, N. C., Jan. 24-28, 1927.

AMERICAN CONCRETE INSTITUTE, Detroit, Mich.; Annual Meeting, Chicago, Ill., Feb. 22-24, 1927.

The Michigan Engineering Society will hold its fall meeting at the Olds Hotel, Lansing, Mich., on Nov. 18 and 19. Papers will include: "Michigan Plat Laws," T. O. Williams; "The Water-Ratio Method of Making Concrete," J. H. Wasson; and "Prevention of Stream Pollution," E. D. Rich.

The Princeton Engineering Society, of Princeton University, announces that student branches of the American Society of Civil Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers have been formed, and that all of them are combined into the Princeton Engineering Society.

The Society of Automotive Engineers, headquarters New York City, will hold a "Transportation and Service Meeting" at the Copley Plaza Hotel, Boston, Mass., Nov. 16 to 18, with papers of interest to railroad and highway engineers on the subjects of the motor truck's place in transportation, the relation of trucking to the railroads, and the relation of motor vehicle transportation to the highways.

Personal Notes

KARL R. KENNISON, chief engineer of the South Essex Sewerage District, and consulting engineer, Boston, Mass., has been chosen designing engineer for the special construction commission which is to provide a new water supply for the Boston Metropolitan District. Mr. Kennison has been connected with dam and power plant construction in New England and has specialized in consulting work on water supply and power investigations and reports.

H. M. LULL, chief engineer of the Southern Pacific Ry. (Texas and Louisiana Lines), has been appointed assistant to the president, with office at Houston, Tex. R. W. BARNES, construction engineer of the same lines, has been appointed chief engineer, to succeed Mr. Lull. E. A. CRAFT has been appointed to the newly established position of engineer of maintenance-of-way, with office at Houston.

L. B. ALLEN, superintendent of maintenance-of-way of the Chesapeake & Ohio Ry., has been appointed assistant to the president, with office at Richmond, Va. C. J. GEYER has been appointed engineer of maintenance-of-way, succeeding Mr. Allen, but with change in title from superintendent of maintenance to engineer of maintenance.

HENRY HAGEL, formerly connected with Stone & Webster, Boston, Mass., and previously with the Aluminum Co. of America in South American service, also with the American International Corporation, Hog Island, has accepted a position with the Lukens Steel Co. as sales engineer to represent the company on the west coast of Florida with offices at 714 Wallace S. Building, Tampa. His technical education was obtained at Carnegie Tech. and Drexel Institute.

JOHN S. CRANDELL, consulting engineer for the Barrett Co., has been appointed professor of highway engineering in the University of Illinois, effective Sept. 1. Professor Crandell was for four years a member of the engineering faculty of the Pennsylvania State College, and for the past eleven years has been in the employ of the Barrett Co., serving first as special representative and later as consulting engineer. Professor Crandell has studied highway problems at home and abroad and has written numerous technical articles on highways and related problems.

W. H. O'BRIEN has been added to the field engineering staff of the Southern Pine Association; he will have his headquarters in the Chicago office where he will assist Lee Kraemer, field engineer. Mr. O'Brien is a graduate of Armour Institute of Technology and has had experience in construction work, railway bridge inspection for the Illinois Central R.R., sales work with the Concrete Engineering Co., Detroit, construction estimating with James Stewart & Co., and office engineer in the Milwaukee office of the Portland Cement Association.

C. WADSWORTH EDWARDS announces the opening of an office in the News-Press Building, 45 Market St., Poughkeepsie, N. Y., for the practice of consulting engineering.

FRANKLIN HALL, who was a former chief engineer at the Erie Proving Grounds, Erie, Pa., has accepted a position as superintendent of the Sexton Engineering Co., Mineola, N. Y.

Obituary

FRANCIS E. NIPHER, professor emeritus of physics at Washington University, St. Louis, Mo., died Oct. 7. He was born at Byron, N. Y., in 1848, graduated from the University of Iowa in 1870 and went to Washington University as professor of physics in 1873.

EDWARD N. LAKE, consulting electrical engineer, Chicago, and general manager of the firm of Chicago Engineering Associates, died at his home at Wheaton, Ill., Oct. 15 at the age of 62 years. Mr. Lake was connected at one time with the Chicago Edison Co., the B. J. Arnold Co. and the Stone & Webster Co., and president of the Lake Engineering Co.

CHARLES S. BUTTS, engineer of the Department of Public Utilities, St. Louis, Mo., died Sept. 28. Some years ago he was traffic engineer of the Department of Public Utilities; later he was engineer of construction for a municipal dock on the Mississippi River at St. Louis.

CLAUDE R. ALLING, vice-president of Underwriters' Laboratories, Inc., Chicago, Ill., died Oct. 25 in Evanston, Ill., aged 42 years. Mr. Alling was born in Wilmette, Ill., and was educated at Denver University, Northwestern University, and Armour Institute of Technology. His education and his whole experience were devoted to fire protection engineering. He joined the staff of Underwriters' Laboratories in 1907 as assistant to the chief engineer and was successively assistant and division engineer, engineer of the department of casualty and automotive engineering, assistant to the president, and vice-president. His work was successively in fire door design, the essential features of design and methods of testing sprinkling systems, and general fire protection practices.

THOMAS REILLY, contractor, Philadelphia, died Oct. 26 at his home in that city aged 68 years. He was chiefly noted for his work in the building of large church edifices throughout the country and also of many college buildings for various schools.

Construction Equipment and Materials

A SECTION DEVOTED TO WHAT THE MANUFACTURER IS DOING FOR THE ENGINEER AND CONTRACTOR

Used Equipment Suggestions to Maker and User

An Equipment Distributor Charges That Too Many Manufacturers Are Dealing in Used Construction Machinery

Sir—Referring to the article in the Sept. 30 issue relative to the market of used machinery.

The manufacturer who expressed his idea that it would be "a fine thing if each territory had a reliable used equipment dealer," I believe was thinking along the correct line for the solution of the proposition.

The manufacturers as a whole are not encouraging the used equipment dealer as an outlet for used equipment. The consensus of opinion of manufacturers, according to your article, is that trade-ins are a losing venture for them. If so, why do they enter the used equipment field in competition to the used equipment dealers? A manufacturer will offer a re-built machine on the deferred payment plan. The contractor expects cash for his used machine. The dealer pays cash and should sell on the same terms with a fair margin of profit added. A machine rebuilt by the original manufacturer will bring a price ten to twenty per cent higher than the machine offered by the dealer even though both machines were in the same condition. The manufacturer also has the deferred payment plan as an added attraction. The value of the used machine should be left to the used equipment dealer and the contractor as they both know the actual condition. The dealer cannot bid against the manufacturer on used equipment.

The problem will be solved from the contractor's standpoint when he gets the idea out of his mind that he can sell his equipment as well as can the dealer who is in touch with the market and acquainted with dealers in different parts of the country. *My advice to the contractor is "Do not go shopping" when in the market to sell or purchase used equipment.* He should list his equipment as well as inquiries with one dealer in whom he has confidence. If the dealer knows he has exclusive sale, he can afford to spend money on advertising and enlist the services of his associate dealers in different parts of the country with the assurance that any arrangement he makes with them will be carried out without loss to him. Some contractors will get an idea from the dealer as to the market value of their equipment and then advertise it themselves. This method acts against their interests as no dealer will offer equipment advertised by the owner. This feeling on the part of the dealer toward advertised equipment will change when owners stop quoting contractors the same price as dealers. There should be a 10 per cent discount to the dealer. The practice of giving the dealer the "double-shuffle" and buying direct by the purchaser after the dealer has spent time and money in locating the machine, is a method which has done much to keep dealers from expanding the used equipment business, as they prefer to deal only with those that they know will maintain clean business methods.

Let the manufacturer keep out of the used equipment business and the contractor co-operate with the one that he selects as his equipment dealer and I am sure the results will be to the mutual interest of all concerned.

The used equipment dealer should not be a party to any sale where the machine is not known to him to be in good working condition. The quicker machinery not in that class goes to the scrap yard, at the current price for junk, the better it will be for the contractor and for the sale of good used equipment as well as for new.

J. T. WALSH, Construction and Industrial Equipment.

Buffalo, N. Y.,
Oct. 15, 1926

Power Shovel Company to Open New Plant

The Speeder Machinery Corp., manufacturing gasoline shovels, cranes and drag lines at Fairfield, Ohio, will soon remove its factory and general offices to Cedar Rapids, Iowa, where it is building a new modern plant. It is expected that the new plant will be occupied in time to start production January 1, 1927. Until then, production will be maintained at the Fairfield plant. The new location is said to offer a greater labor market, and to give improved shipping arrangements. The new plant will also greatly enlarge the company's facilities.

A sales and service office has been opened at 90 West St., New York City, in charge of D. W. Lehti, who will have charge of the eastern New York and New England territory. Further announcement gives a number of new district sales representatives: H. E. Parsons, Pacific Coast district; R. E. Coop, southwestern district; W. H. Boyd, southern district; L. A. Bartlett, eastern district.

Chain Belt Company Erecting New Engineering Building

The new engineering building being constructed by the Chain Belt Company, Milwaukee, at its West Milwaukee Works, is the third major unit to be erected on this 59 acre site and is part of the general plan to gradually move the Milwaukee plant, now located at 16th Avenue and Park Street, to the larger tract in West Milwaukee. The new engineering building will house the steel fabricating and assembly departments, drafting room and general contract engineering offices. But when it is completed approximately half of the organization will be located at the West Milwaukee works. The new building will be 308 ft. long and 120 ft. wide, with the exception of the office building which will be 144 ft. wide. Frank B. Chase, Inc., of Chicago, are the engineers and designers.

Business Notes

SHIRLEY S. FRENCH, formerly vice-president and general manager of the General Fireproofing Co., Youngstown, Ohio, has been appointed president, The Berger Mfg. Co., Canton, Ohio, a division of the Central Alloy Steel Corp.

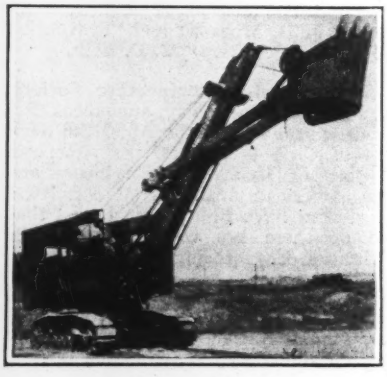
G. S. SWANSON has been appointed district sales manager in charge of sales and service, Pittsburgh office of the G. H. Williams Co., Erie, Pa.

FOOTE CO., INC., Nunda, N. Y., announces that the Multi Foote Sales Co., 2811 West Fulton St., Chicago, will in the future handle the sales and service of its pavers. Clarence Dunkle, for many years connected with the Foote Co., will be manager of the new sales organization.

New Developments

All-Steel Construction Feature of New Line of Gas Shovels

New models of gasoline powered shovels, built in sizes of ½, ¾, 1 and 1¼ cu.yd. capacity, constitute a complete new line that is being introduced by the Harnischfeger Corp., Milwaukee, Wis. In order to secure maximum rigidity and long life, the machines are built entirely of steel, heavy one-piece steel castings being used wherever possible. Besides providing long wear, this cast-steel construction aids in keeping the various shafts in proper alignment. All shafts are of chrome manganese steel.

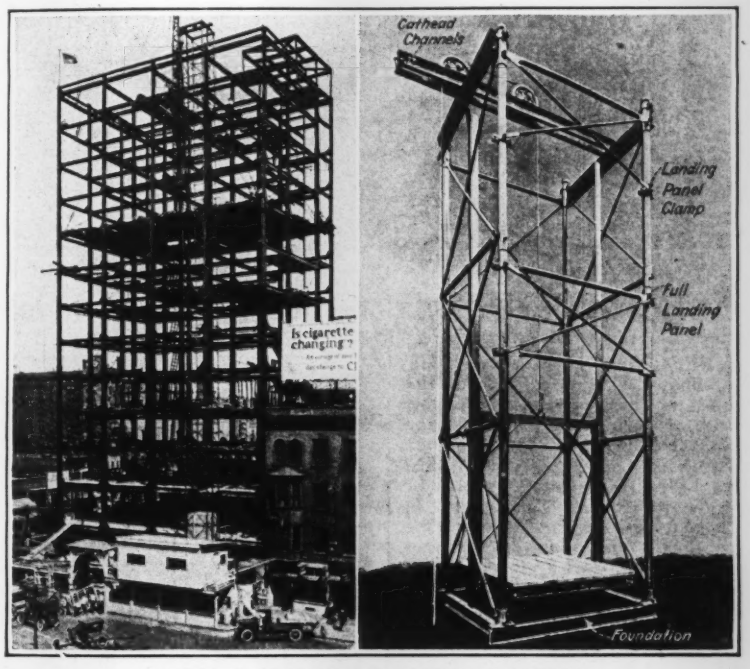


The shovels have been designed with a short tail-swing as a special aid to the basement contractor and others who have to work in narrow, cramped locations. The crowding mechanism is capable of forcing the dipper above the boom point as shown in the illustration. It is independent of the hoisting mechanism and permits a rapid reverse movement which facilitates the unloading of sticky soil.

Two traction speeds are provided, the higher speed for travel between jobs. All the models are changeable to a crane by means of a patented drum spider and lagging. The lagging is all that is necessary to change in converting from shovel to crane. The machine shown in the illustration is of 1-yd. capacity.

New Construction Tower Made of Tubular Members

A construction tower recently offered to the contracting field by the Dravo Equipment Company, of Pittsburgh, Pennsylvania, utilizes tubular sections for its members, the leg sections, struts, braces and guides, all being interchangeable in order to simplify and speed up erection. It is claimed that this tower can be erected at one-third to one-half the cost of any other type, from 100 to 156 feet having been erected in an eight hour day.



TOWER OF TUBULAR STEEL MEMBERS

There are two types of towers, each type embodying three sizes. The type B, two-wheelbarrow size, and type BB, three-wheelbarrow size—each has a live load capacity of 3,000 pounds and a maximum height of 110 feet; and the type B-2, double tower, with two 2-wheelbarrow cages has the same live load, capacity and height. The type A, two-wheelbarrow, and type AA, three-wheelbarrow, have a live load capacity of 5,000 pounds. The type A-2, double tower with two 2-wheelbarrow cages also carries a capacity of 5,000 pounds live load for each cage. All types of A towers can be built to 300 feet, and by using extra heavy tubing which is interchangeable with the standard, this height may be extended to 400 feet.

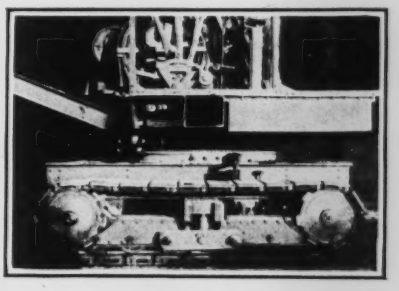
The base of the tower is an assembled frame of I-beams on each corner of which is set a casting for taking the leg sections of each panel. In the type A towers the leg members are three inches, the struts two inches, and the braces one inch in diameter. In the type B towers the leg members are two inches, extra heavy, the struts one and one-half inches, and the braces three-quarter inch in diameter. Provision is made for landing platforms to accommodate the various floor levels. On top of the tower is a cathead made up of six inch channels with spacers and seven-eighth inch tie bolts. This assembly carries the bearings and the sheave wheels. The cathead can be placed in any position, square or diagonal across the tower. The towers may be either leased or purchased outright.

A Steam Crawler Crane of German Manufacture

The Ardeltwerke G. m. b. H. Eberswalde, a large manufactering concern near Berlin, is featuring a crawler crane, a description of which is indicative of one type of equipment being offered to the German contractor.

The capacities given are 6 tons at 15-ft. 7-in. radius and 2 tons at 29-ft. 7-in. radius, when working with a hook and 3 tons at 23-ft. radius when working with a grab bucket. Working speeds are listed as follows: Up to 3 tons, 100 ft. per min; from 3 to 6 tons, 50 ft. per min; slewing, 2 ft. per min; travel, 50 to 100 ft. per min. The power unit is a 2-cylinder, reversing steam engine with 6½x7 in. cylinders running at 180 to 200 r. p. m. A vertical cross tube boiler is used with a heating surface of about 86 sq.ft., using a pressure of about 120 lb. per sq.in.

The boom, frame and platform are of channel iron construction. A wooden

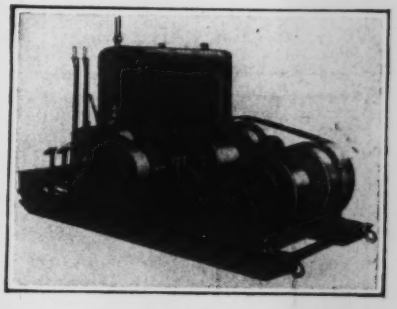


cab is used. Wheels and pulleys are of cast steel, while the drivers and shafts are of forged steel. All spur wheels and bevel spur wheels are machined.

The crawlers are driven either together or separately. The crane is provided with lighting equipment, electricity being supplied by a flexible cable 100 ft. long wound on a cable drum. The vertical loads of the crane are carried on 2 ft.x6 in. roller bearing on the crawler tread. The driving wheels do not support any load. Soil pressure is about 28½ lb. per sq.in. If desired, the machine can be equipped with boilers fired by oil fuel or a Diesel or a gasoline engine or an electric motor may be supplied.

A New Line of Hoists in One, Two and Three-Drum Types

Hoists built on the unit plan, that is, designed so that additional drums may be added up to a total of three, have been made available by the Construction Machinery Co., Waterloo, Iowa, as a new line of non-reversible hoists with a load capacity on single lines of from 2,000 to 8,000 lb. at 165 ft. per min. Heretofore the company has only built hoists with capacities up to 2,000 lb. The new line of hoists has the operating levers grouped at the rear of the



hoist so that the operator always has a forward view of all operations in and about the equipment.

The power units are gasoline engines, ranging in capacity from 15 to 60 hp. An additional feature is the fact that a boom swinger can be attached in place of the third drum.

Engineering News-Record Statistics of the Construction Industry

Nov. 4, 1926 — *in the United States* — Vol. 97, No. 19

Engineering News-Record CONSTRUCTION COST Index Number (1913 = 100)

MONTHLY

January, 1925 to Date

November, 1926	**210.80**
October, 1926	209.80
November, 1925	205.95
Peak, June, 1920	273.80
1913	100.00

1925

Jan.	210.40	May	207.20	Sept.	202 10
Feb.	209.70	June	204.60	Oct.	205.35
March	210 20	July	204.60	Nov.	205.95
April	209.55	August	204.60	Dec.	205.95

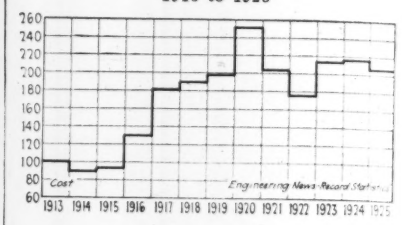
1926

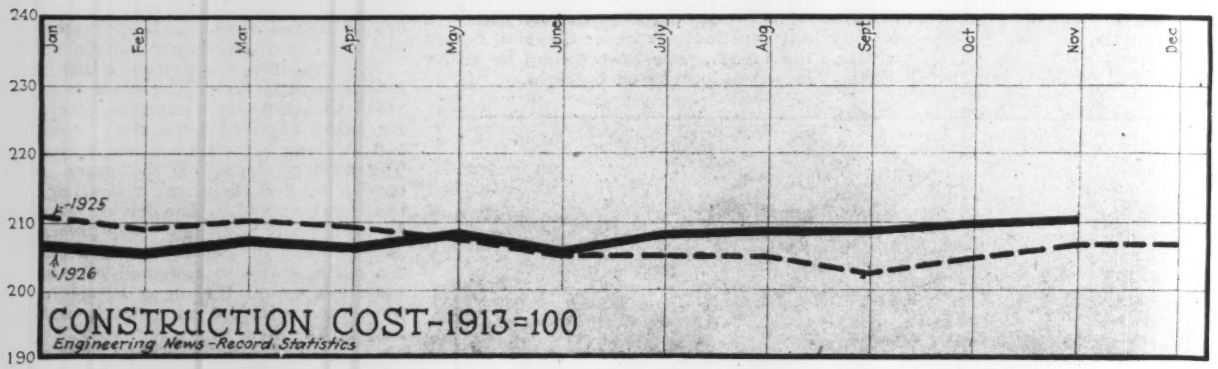
Jan.	207.15	April	207.05	July	207.80
Feb.	206.55	May	207.30	Aug.	208.30
Mar.	207.65	June	204.80	Sept.	208.30

ENGINEERING NEWS-RECORD'S Construction Cost Index Number is slightly above the October level, owing to upward adjustments in wage schedules, occurring mostly in the West. The average rate for common laborers is 55½c. per hr. for the entire country as compared with 55c. one month ago and 54c. at this time last year. Thus, general construction cost is 2 per cent above November, 1925, 23 per cent under the peak and 110 per cent above the 1913 level.

YEARLY

1913 to 1925





Engineering News-Record CONSTRUCTION VOLUME Index Number (1913 = 100)

MONTHLY

January, 1925 to October, 1926

October, 1926	**244**
September, 1926	227
October, 1925	233
Peak, August, 1925	266
1913	100

1925

January	141	May	209	September	262
February	145	June	214	October	233
March	161	July	178	November	194
April	211	August	266	December	206

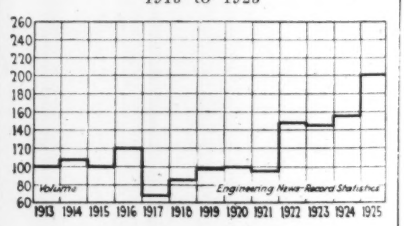
1926

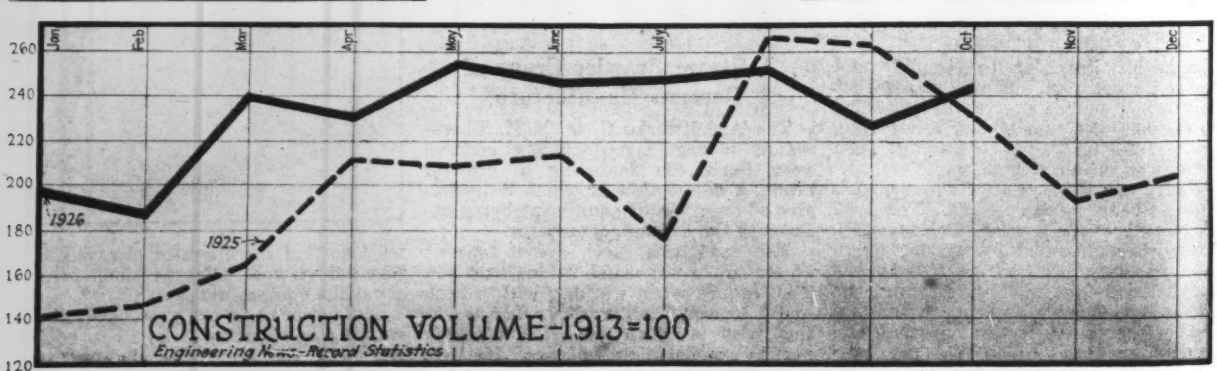
Jan.	198	Mar.	240	May	254
Feb.	187	April	233	June	246
July	248	August	252		

ENGINEERING NEWS-RECORD'S Construction Volume Index Number is 244 for the month of October and 201 for the whole of 1925, as against 100 for 1913. This means that the actual volume of contract letting in 1925 (not the mere money-value of the contracts let that year) is 101 per cent above the volume for 1913. The monthly volume number, 244 for October, 1926, contains the increment of construction and indicates the rate at which contracts are being let as compared with 1913 awards.

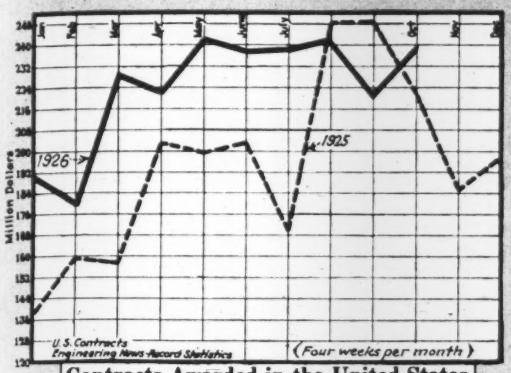
YEARLY

1913 to 1925

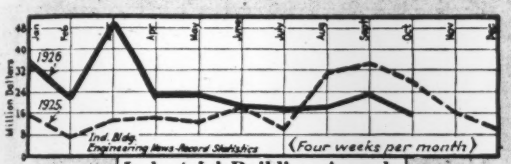




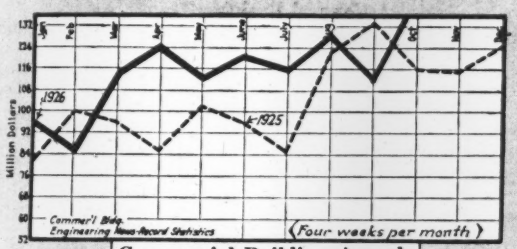
Monthly Statistics of the Construction Industry



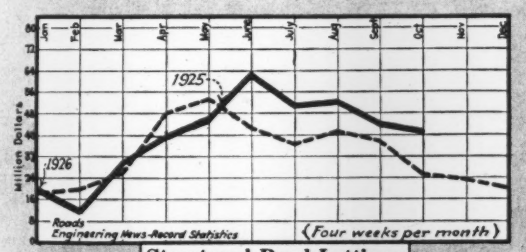
Contracts Awarded in the United States
Reported in E. N.-R.



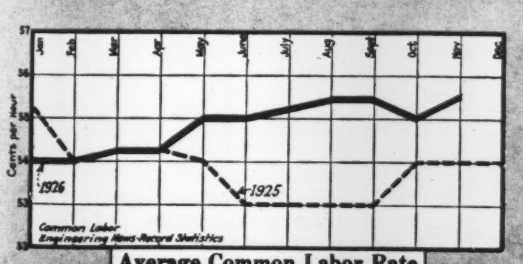
Industrial Building Awards
$40,000 and Over



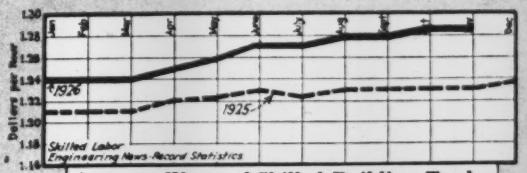
Commercial Building Awards
$150,000 and Over



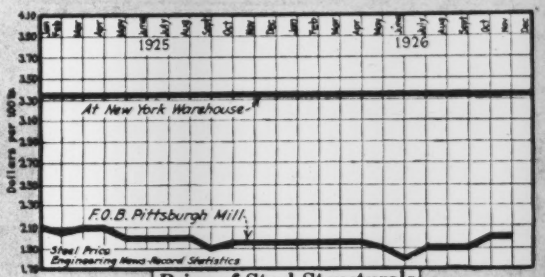
Street and Road Lettings
$25,000 and Over



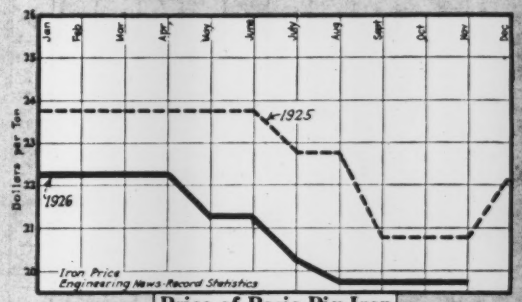
Average Common Labor Rate
Pick and Shovel Men



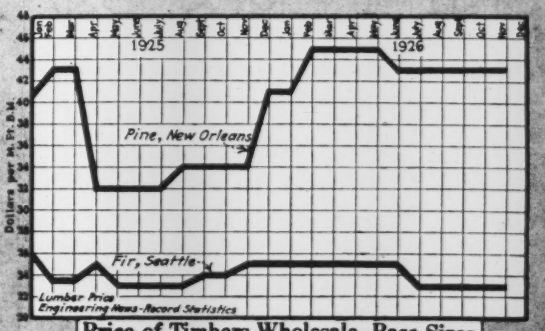
Average Wage of Skilled Building Trades
Bricklayers, Carpenters and Steel Erectors



Price of Steel Structurals
Shapes 3-In.; Plates ¼-In.



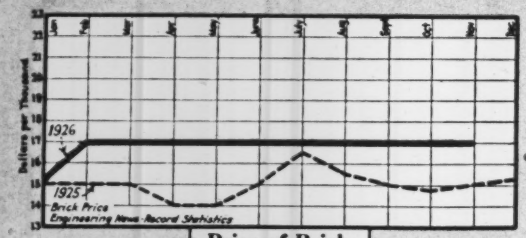
Price of Basic Pig Iron
F.o.b. Pittsburgh



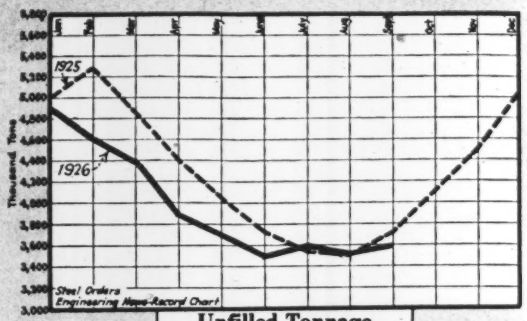
Price of Timbers, Wholesale, Base Sizes
Car Lots to Contractors

Net Price of Portland Cement
Car Lots, F.o.b. Chicago

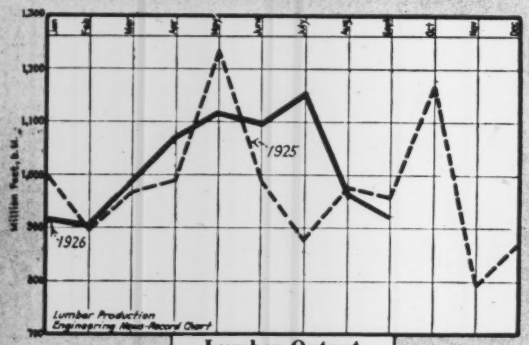
Monthly Statistics of the Construction Industry



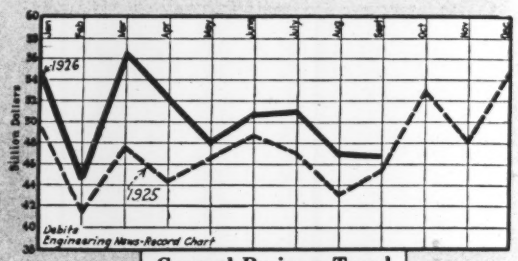
Price of Brick
At Dock, New York



Unfilled Tonnage
On Books of U. S. Steel Corp.

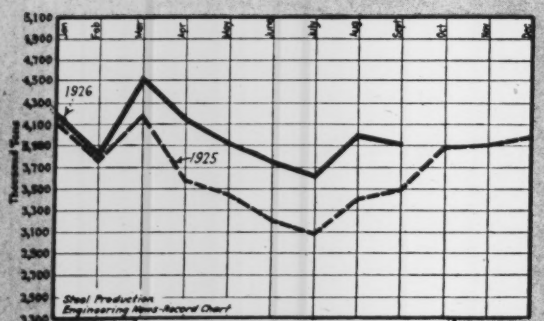


Lumber Output
Nat. Lumber Mfrs. Assn.

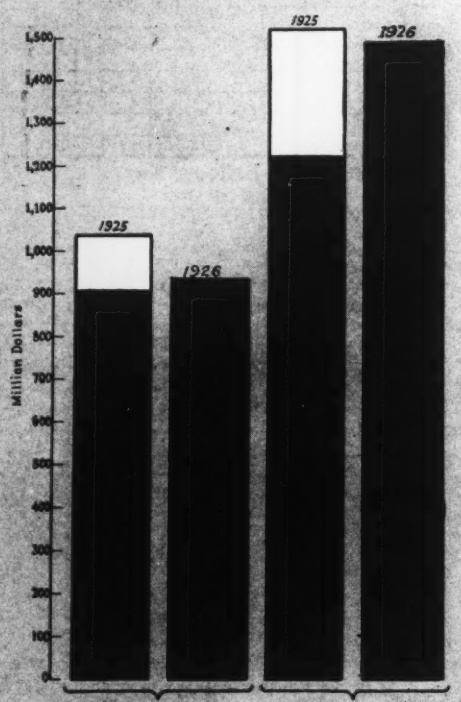


General Business Trend
Bank Debits—Federal Reserve

Cement Mill Stocks
Bureau of Mines



Steel Ingot Output
Gross Tons; Am. Iron and Steel Inst.



Public—Contracts—Private
Jan. 1 to date ▬
Reported by E. N.-R.

October Contracts Show Unseasonal Gains in Commercial Buildings, Sewers, Excavations, Etc.

Building Permits Below Normal

THE total money value of engineering construction contracts awarded Jan. 1 to Nov. 1, 1926 is 14 per cent greater than that for the corresponding period last year, according to *Engineering News-Record* statistics.

Proposed work represents a slightly greater gain (15 per cent) compared with the first ten months of 1925.

Marked gains in contract letting were noted during October in sewers; excavation, drainage, irrigation, levee, river and harbor work; commercial buildings; and unclassified public projects.

Heavy increases in proposed work occurred during the last month in water-works, sewers, and various unclassified jobs.

The foregoing is in direct contrast with the recent slump in building permits. The fact that the latter has fallen about 2 per cent below the point of normal seasonal decline would indicate that further recession in the volume of general construction will affect mostly speculative buildings of a residential nature.

October gains in volume of contract letting developed in fifteen states, by classes, as follows: Sewers—Illinois, New York, Maryland, Florida, Alabama; bridges—Indiana, West Virginia, Maryland, Oklahoma, Illinois; streets and roads—Alabama, West Virginia, Utah, Idaho, Oklahoma, Illinois; commercial buildings — Indiana, Alabama, Maryland, New Jersey, New York, Washington, Colorado, Illinois; public buildings—Florida, New Jersey, California, Illinois; Federal Government—Wyoming, California, Maryland, Florida; excavating—California, New York; water-works — Maryland; industrial buildings—Alabama; unclassified projects — Washington, California, New York, Maryland, Indiana, Illinois.

In the accompanying table of contracts awarded for the month of October, a minimum value was adopted on each class, in order to eliminate the small jobs and present a concentrated total for engineering construction throughout the entire country. Minimum values were: Water-works and excavating jobs, $15,000; other public works, $25,000; industrial buildings, $40,000; commercial, educational, religious and other buildings, $150,000. The excavating work comprises drainage, irrigation, levee, river and harbor projects.

The average weekly totals of engineering contracts awarded in the United States for the month of October, 1913 to 1926, are as follows:

1913	$10,008,000	1920	$23,492,000
1914	10,950,000	1921	24,978,000
1915	11,886,000	1922	33,672,000
1916	14,001,000	1923	39,436,000
1917	16,762,000	1924	39,277,000
1918	15,065,000	1925	55,603,000
1919	49,743,000	1926	59,711,000

Taking October engineering contract totals (entire U. S.) for the last fourteen years and correcting the figures for all price inflation occurring during that period and we have, with 1913 equaling 100, the following comparison:

1913	100	1920	79
1914	108	1921	130
1915	101	1922	154
1916	97	1923	154
1917	87	1924	164
1918	67	1925	233
1919	207	1926	244

Principal among the last month's largest awards, were the following:

Power plant and paper mill, Ontario, Canada, Spruce Falls Power & Paper Co., to Morrow & Beatty, Ltd., Peterborough, $12,000,000.

Cathedral of Learning, Pittsburgh, Pa., University of Pittsburgh, to Stone & Webster, Boston, $7,000,000.

Loft and office building, New York, N. Y., C. G. Edwards Syndicate, to G. Richard Davis & Co., Inc., $6,000,000.

Office and store, Chicago, Ill., Estate of Marshall Field, to Henry Ericsson Co., and others, $5,000,000.

Theatre, hotel, stores, Chicago, Ill., A. Karsas, to Longacre Constr. Co., $5,000,000.

Office and hotel, Los Angeles, Calif., State Societies of Southern California, to S. H. Shave Constr. Co., $3,500,000.

Club, New York, N. Y., American Womens Realty Assoc., Inc., to Marc Eidlitz, $3,000,000.

Value of Contracts Let in the United States and Canada During October, 1926

	New England	Middle Atlantic	South	Middle West	West of Mississippi	Far West	United States	Jan. 1 to Date U. S.	Canada
Waterworks	$447,000	$514,000	$182,000	$2,708,000	$204,000	$159,000	$4,214,000	$52,231,000	$30,000
Sewers	289,000	4,222,000	1,684,000	3,934,000	766,000	886,000	11,781,000	87,813,000	56,000
Bridges	50,000	2,149,000	557,000	1,929,000	1,197,000	279,000	6,161,000	71,838,000	389,000
Excavation, drainage, irrigation	11,000	480,000	16,000	450,000	507,000	3,284,000	4,748,000	25,350,000	28,000
Streets and roads	125,000	9,083,000	5,044,000	11,181,000	9,132,000	6,344,000	40,909,000	434,633,000	719,000
Industrial building	2,145,000	1,620,000	1,991,000	7,756,000	1,423,000	426,000	15,361,000	258,507,000	.....
Commercial building	10,610,000	54,566,000	5,830,000	46,499,000	4,161,000	22,484,000	144,150,000	1,262,268,000	3,900,000
Federal Government	12,000	779,000	369,000	279,000	360,000	688,000	2,487,000	46,649,000	.....
Unclassified	339,000	1,561,000	362,000	2,281,000	608,000	3,882,000	9,033,000	178,134,000	169,000
October, 1926	$14,028,000	$74,974,000	$16,035,000	$77,017,000	$18,358,000	$38,432,000	$238,844,000	$2,415,362,000	$5,291,000
September, 1926	33,620,000	70,027,000	24,354,000	63,210,000	52,341,000	32,905,000	276,457,000	.....	8,254,000
October, 1925	22,798,000	105,328,000	19,896,000	62,019,000	30,382,000	37,594,000	278,017,000	.....	13,007,000
January 1 to date, 1926	203,318,000	737,968,000	242,660,000	610,059,000	357,240,000	264,117,000	2,415,362,000	.....	100,387,000
January 1 to date, 1925	176,153,000	769,982,000	203,116,000	383,902,000	356,152,000	237,619,000	2,126,924,000	.....	75,850,000

Labor Rates and Conditions Throughout the Country

Fewer Strikes and Wage Controversies

PROJECTED construction work is in sufficient volume to maintain employment in the skilled building trades at practically the same levels held during the boom period, 1922 to 1926.

Common, unskilled laborers, however, may experience seasonal slackness during the next three months.

The number of serious strikes or other controversies in the construction industry throughout the country, is remarkably small.

Settlements have been reached in most of the major disputes and it is thought that the recent recession in speculative housing construction may have helped dispose of the nine or more important strikes which were active three months ago, and may also have prevented any more from arising.

Some of the other industries that show employment of labor at a sustained normal rate of activity are: lumber, textiles, boots and shoes, automotive, coal mining (bituminous and anthracite) and metal mining. In none of the other principal industries is there a slackening of operations to any alarming degree.

Production in the basic industries, thus far this year, has not touched the low point reached in 1923, the heaviest production year since the depression of 1921. Total earnings and employment of factory workers continue in the upward movement started back in July of the current year.

Among the principal wage adjustments of the month were: the rise of 12½c. per hr. granted sheet metal workers in St. Louis; the advancing of Pittsburgh stone masons to $1.56½ per hr.; and increased wages for shop and other railway workers and coal miners.

The clash between union and open-shop carpenters in San Francisco, started seven months ago, has resulted in eight indictments for violence thus far, according to latest reports from the affected area.

Philadelphia carpenters in their drive against open-shop mill work, are greatly hampered by slackness in demand for this craft in the local market.

Current Building Trades Wage Rates Per Hour

(Higher rates indicated by +, decreases by —)

Cities	Bricklayers	Carpenters	Hoisting Engineers	Hod Carriers	Pile Drivers	Structural Iron Workers	Common Labor
Atlanta	$1.12½	$0.70	$0.70	$0.50	.....	$0.75	$0.25@.30
Baltimore	1.62½@1.75	1.00@1.10	1.00@1.12½	1.00	$0.65	1.12½	.40
Birmingham	1.00@1.50	.40@1.05	.75@1.00	50@.75	.....	.75@1.75	.20@.40
Boston	1.40	1.25	1.25	.79	1.15	1.25	.50@.74
Cincinnati	1.50	1.31¼	1.31¼	.95	1.31¼	1.31¼	.45@.58
Chicago	1.62½	1.50	1.50	.90	1.37½	1.50	.90
Cleveland	1.50	1.25	1.30	.87½@1.10	1.10	1.50	.87½
Dallas	1.62½	1.12½	1.00	.40@.75	1.00	1.00	.30@.50
Denver	1.62½	1.25	1.12½@1.18¾	.81¼@.87½	1.00	1.15⅝	.40@.55
Detroit	1.50	.90@1.15	.85@1.00	.90	.85@1.00	1.12½	.50@.60
Kansas City, Mo	1.50	1.17½	1.25	.90	1.12½	1.25	.35@.75
Los Angeles	1.50	1.00	1.00	1.12½	.80	1.00	.50
Minneapolis	1.25	.87½@.95	.87½	.75	....	1.00	.45@.60
Montreal	1.00@1.25	.75	.60	.40	.50	.75	.30@.35
New Orleans	+1.50	.90	1.00	.75	.80	1.25	—.30@.40
New York	1.75	1.50	1.75	1.12½	1.00@1.12½	1.75	.90⅝
Philadelphia	1.50@1.62½	1.12½@1.25	1.02¼	1.12½	1.00	1.12½@1.25	.45@.50
Pittsburgh	1.62½	1.50	1.37½@1.50	1.12½	....	1.50	.80
St. Louis	1.75	1.50	1.50@1.65	1.15@1.25	1.25	1.50	.45@.75
San Francisco	1.25	1.00	1.00	.81¼	1.00	1.12½	.50@.55
Seattle	1.37½	1.12½	1.00@1.12½	1.00	1.00@1.12½	1.12½	.50@.62½

Painters returned to work without officially calling off a strike recently begun. In addition to unemployment in the carpenter trade in Philadelphia, similar conditions are also noted among cement finishers, painters, and steam fitters. Other crafts in fair demand.

Employment in Detroit machine shops is reported as having dropped off gradually during the last two weeks.

Birmingham affords employment to the skilled building trades. A small number of common laborers, however, are out of work.

No unemployment has developed among skilled building trades mechanics in the other fifteen important industrial districts reporting regularly to *E. N.-R.*

Monthly Prices of Construction Materials

Ups and Downs of the Market

STEEL demand is perceptibly slower than it was three weeks ago; much of the recession, however, is due to seasonal influences. Lumber quotations show little strength owing, no doubt, to the general drop in housing construction. Coke scarcity and higher fuel prices prevent any further decline in iron. The situation as a whole, reveals few important price fluctuations during the month.

Pig Iron—Further reductions in iron prices between now and the end of the year are improbable, especially since reserve stocks are low, coke is scarce and fuel prices generally are at the highest levels reached during the last six years. Minimum on No. 2 foundry at Birmingham is $20 per ton, the same as it was a year ago.

Railway Supplies—Rails and track supplies are in good demand with mill prices firm. Drop in buying of car materials occurred during the last three weeks.

Pipe—Present movement of steel pipe is notably active compared with lessening of demand in other steel products. Cast-iron pipe holds at Oct. 1 levels. Sewer pipe advanced slightly about a month ago at the principal factory points on all sizes from 3-in. to 36-in., with the exception of 27-in. and 30-in. pipe. Price schedules, however, have since reverted to the Sept. 1 levels. Soil pipe prices are approximately 10 per cent above those obtaining Jan. 1, 1926.

Road and Paving Materials—The only changes during the month in twenty-one cities reporting to *E. N.-R.* were a slight drop in road oils at St. Louis, an advance of $1 per ton on package asphalt in Baltimore, and lower prices for wood blocks in the Boston and Minneapolis markets.

Sand, Gravel and Crushed Stone—The market in this group will probably remain stable until freezing weather sets in. Sand and gravel advanced sharply in Chicago Oct. 25, no other changes in carload prices developed.

Lime and Cement—The trend in lime is downward. Boston, Dallas, Los Angeles, and Atlanta, all report declines in November prices. Over 75 per cent of the cities listed show cement prices exactly the same as in November, 1925.

Brick and Hollow Tile—Brick is firmer in the South. Approaching cold weather will close many of the plants in Northern districts with resultant seasonal scarcity of brick. Drop in demand, also seasonal, serves to prevent any unusual fluctuation in fall prices. Hollow tile has settled to levels comparable with those of November, 1925.

Structural Steel—Demand is definitely slower than it was three weeks ago, in structural shapes, reinforcing bars, rivets, bolts, nuts, sheets, wire products and tin plates. The drop in buying of sheets, flats, strips, etc. is mostly due to normal seasonal slowing down at the automotive plants; the same conditions apply to tin plates. Steel plates, however, seem moderately active but with prices unable to go above $1.90 per 100 lb., f.o.b. Pittsburgh mill. Shapes and bars bring $2 per 100 lb. in large tonnages with single carload lots, $2.10 per 100 lb., Pittsburgh; these same quotations prevailed a month ago.

Lumber—Declines continue in excess of advances but are no more marked in one species than in another. Slowing down in small housing construction rather than in large engineering projects is probably responsible for the present lack of strength in lumber quotations.

Linseed Oil—The market for raw oil has evidently recovered from the downward tendency evident during the first part of October. The price f.o.b. New York for 5-bbl. lots is now 87c. per 7½-lb. gal. as against 85½c., one month ago.

Scrap—Dullness prevails in scrap iron and steel and also in the non-ferrous metals. With pig iron in its present position, chances of improvement in scrap are slight.

Next week—*"Detail Replacement Costs of an Office Building Erected in* 1914."

E. N.-R. Prices of Construction Materials

Price advances since last month are indicated by **heavy type**; declines by *italics*

PIG IRON—Per Gross Ton f.o.b.:

	Nov. 4	One Year Ago
CINCINNATI		
No. 2 Southern (silicon 2.25@2.75)	$24.19	$23.05
Northern Basic	20.39	22.27
No. 2 Southern Ohio (silicon 1.75@2.25)	21.39	22.77
NEW YORK, tidewater delivery		
Southern No. 2 (silicon 2.25@2.75)	*26.37*	27.37
BIRMINGHAM		
No. 2 Foundry (silicon 2.25@2.75)	20.00	20.00@21.00
PHILADELPHIA		
Eastern Pa., No. 2X (2.25@2.75 sil.)	22.76	22.26
Virginia No. 2 (silicon 2.25@2.75)	*28.17*	29.17
Basic	21.26	21.16
CHICAGO		
No. 2 Foundry Local (silicon 1.75@2.25)	*21.00*	22.00
No. 2 Foundry Southern (silicon 2.25@2.75)	*24.55*	25.55
PITTSBURGH, including freight charge ($1.76) from the Valley		
No. 2 Foundry Valley (silicon 1.75@2.25)	**20.26**	20.77
Basic	19.76	20.77
Bessemer	**20.76**	20.77

SCRAP—The prices following are f.o.b. per net ton paid by dealers:

	New York*	Chicago	Birmingham
No. 1 railroad wrought	$14.00@$15.00	*$12.50@$13.00*	*$12.00@$12.50*
Stove plate	10.00@ 11.00	14.00@ 14.50	14.00@ 14.50
No. 1 machinery cast	16.00@ 17.00	*16.25@ 16.75*	17.00@ 17.50
Machine shop turnings	9.25@ 9.75	*6.50@ 7.00*	8.00@ 8.50
Cast borings	10.00@ 10.25	*8.50@ 9.00*	8.00@ 9.00
Railroad malleable	16.00@ 16.50	*14.50@ 15.00*	16.00@ 17.00
Re-rolling rails	12.50@ 13.00	*14.50@ 15.00*	15.00@ 16.00
Re-laying rails	23.00@ 24.00	.....	21.00@ 22.00
Heavy melting steel	11.50@ 12.00	*11.50@ 12.00*	13.00@ 14.00

*Gross ton.

BUTT WELD, EXTRA STRONG, PLAIN ENDS

1 to 1¼	60	49½	1 to 1¼	30	14
2 to 3	61	50½			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	53	42½	2	23	9
2½ to 4	57	46½	2½ to 4	29	15
4½ to 6	56	45½	4½ to 6	28	14
7 and 8	52	39½	7 and 8	21	7
9 and 10	45	32½	9 to 12	16	2
11 and 12	44	31½			

STEEL PIPE—From warehouses at the places named the following discounts hold for welded steel pipe:

	Black			
	New York	Chicago	Birmingham	St. Louis
1 to 3 in. butt welded	53%	54%	62%	49%
2½ to 6 in. lap welded	48%	51%	59%	46%
	Galvanized			
	New York	Chicago	Birmingham	St. Louis
1 to 3 in. butt welded	39%	41%	50½%	36%
2½ to 6 in. lap welded	35%	38%	47½%	33%

Malleable fittings, Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36—5% off.

CAST-IRON PIPE—The following are prices per net ton for carload lots:

			New York	
	Birmingham	Burlington, N. J.	Nov. 4	One Year Ago
4 in.	$44.00	*$53.00@54.00*	*$55.60@56.60*	$54.60@55.60
6 in. and over	40.00	*49.00@50.00*	*51.60@52.60*	50.60@51.60
	Pittsburgh	Chicago	St. Louis	San Francisco
4 in.	$52.60	$52.20	$49.60	$54.00
6 in. and over	48.60	48.20	45.60	50.00

Gas pipe and Class "A," $4 per ton extra.

CLAY DRAIN TILE—The following prices are per 1,000 lin.ft.:

	New York					
Size, In.	Nov. 4	One Year Ago	St. Louis	Birmingham	San Francisco	Dallas
3	$45.00	$48.00	$40.00	$45.00	.....	$73.00
4	55.00	50.00	40.00	56.00	$76.50	110.00
5	.....	.....	.....	80.00	97.75	118.00
6	90.00	92.00	70.00	100.00	127.50	150.00
8	160.00	160.00	170.00	165.00	212.50	210.00

SEWER PIPE—The following prices are in cents per foot for standard pipe in car load lots, f.o.b., except as otherwise stated:

Size, In.	New York Delivered	Pittsburgh	Birmingham	St. Louis	Chicago	San Francisco	Dallas
3	....	$0.088	$0.10	.....	$0.09	$0.12	.....
4	....	.088	.10	$0.10	.09	.15	$0.15
5	....	.121	.135	.....	.13½	.18	.18
6	$0.24	.121	.21	.14	.13½	.21	.21
8	.43	.198	.315	.225	.21	.30	.325
10	.50	.231	.45	.315	.31½	.42	.476
12	.65	.297	.54	.405†	.40½	.56	.612
15	1.08†	.396	.75	.675†	.54	.92	1.02
18	1.55†	.55	.90	.945†	.75	1.32	1.53
20	1.89†	.66	1.20	.....	.90	.....	.....
21	.....	.77	1.25	1.25†	.....	.....	.....
22	2.52†	.88	1.35	.....	1.20	.....	1.564
24	2.84†	.99	2.665	1.62†	1.35	2.16	2.04
27	4.65†	2.405	2.952	2.45†	2.75	3.00	3.34
30	5.16†	2.664	3.96	3.00†	3.75	3.60	4.06
33	6.98†	3.60	4.51	3.55†	4.50	....	4.99
36	8.00†	4.10	5.06	3.95†	5.00	.....	5.42

	3	5	8	12	24	36
Boston	$0.125	$0.185	$0.27	$0.55	$2.00†	$5.50†
Minneapolis	.....	.....	.25	.45	1.50†	4.56†
Denver	.135*	.18*	.27	.47	1.70	.....
Seattle	.14	.....	.35	.72†	2.60†	.....
Los Angeles	.1675	.186	.2825	.504	1.74	.....
New Orleans	.116*	.277*	.295	.463	1.785	.....
Cincinnati	.105	.1575	.245	.4725	1.575	4.715
Atlanta	.10*	.15*	.25	.425	1.625	.....
Montreal	....	.50	.90	1.35	4.50	.....
Detroit	.111	.1665	.259	.4995	1.665†	3.7925†
Baltimore	.111	.166	.259	.499	1.665	4.92
Kansas City, Mo.	.15	.21	.29	.52	1.90†	3.80†
Philadelphia	.11	.16	.26	.42	1.50	3.70

*4-in., 6-in., 9-in., respectively. †Double Strength.

Railway Supplies

STEEL RAILS—The following quotations are per ton f.o.b. for carload or larger lots. For less than carload lots 5c. per 100 lb. is charged extra:

	Pittsburgh				
	Nov. 4	One Year Ago	Birmingham	Chicago	St. Louis
Standard bessemer rails	$43.00	$43.00	$43.00	$43.00	.....
Standard openhearth rails	43.00	43.00	43.00	43.00	$51.00
Light rails, 8 to 10 lb.	.....	.....	34@36	1.80@1.90*	2.05-2.15*
Light rails, 12 to 14 lb.	.....	32@34	34@36	1.80@1.90*	1.88-1.98*
Light rails, 25 to 45 lb.	36.00	32@34	34@36	1.80@1.90	*1.84-1.94*
Re-rolled rails	*27@30*	27@30	**34@36**	34@36	18@21

*Per 100 lb.

RAILWAY TIES—For fair-sized orders, the following prices per tie hold:

	6 In. x 8 In. by 8 Ft.	7 In. x 9 In. by 8½ Ft.
Chicago, white oak, plain	$1.45	$1.83
Chicago, empty cell creosoted	1.90	2.45
Chicago, zinc treated	1.70	2.20
San Francisco, green Douglas fir	.84	1.14
San Francisco, empty cell creosoted, Douglas fir	1.70	2.25
St. Louis, white oak, plain	1.20	1.45
St. Louis, zinc treated	1.60	1.85
St. Louis, red oak, plain	1.10	1.35
St. Louis, sap pine-cypress	.95	1.20
Birmingham, white oak	1.25	1.45

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh mill for carload lots, together with the warehouse prices at the places named:

	Pittsburgh					
	Nov. 4	One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ⅝-in. and larger	$2.80@$2.90	$2.80	$3.55	$3.65	$3.80	$3.00
Track bolts	3.90@4.25	3.90@4.15	4.55	4.60	5.35	3.90
Standard section angle bars	**2.85@2.95**	2.75	3.40	3.75	3.60	4.15

Pipe

WROUGHT PIPE—The following discounts are to jobbers for carload lots at Pittsburgh mill:

	Steel			Iron	
Inches	Black	Galv.	Inches	Black	Galv.
	BUTT WELD				
1 to 3	62	50½	1 to 1½	30	12
	LAP WELD				
2	55	43½	2	23	7
2½ to 6	59	47½	2½	26	11
7 and 8	56	43½	3 to 6	28	13
9 and 10	54	41½	7 to 12	26	11
11 and 12	53	40½			

Road and Paving Materials

ROAD OILS—Following are prices per gallon in tank cars, 8,000 gal. minimum f.o.b. place named:

		Nov. 4	One Year Ago
New York, 45% asphalt	(at terminal)	$0.065 @$0.07	$0.065 @$0.0
New York, 65% asphalt	(at terminal)	.0675@ .0725	.0675@.072
New York, binder	(at terminal)	.07 @ .075	.07 @.075
New York, flux	(at terminal)	.07 @ .075	.07 @.075
New York, liquid asphalt	(at terminal)	.07 @ .075	.07 @.075
St. Louis, 40@50% asphalt		*.053*	.05
St. Louis, 50@60% asphalt		*.0523*	.051
Birmingham, 55% asphalt		.0475	.0475
Dallas, 45% asphalt		.0495	.05
Dallas, 50% asphalt		.1455	.046
Dallas, binder		.061	.062
San Francisco, binder, per ton		12.00*	13.50*

* F.o.b. Oleum, Cal. Freight to San Francisco, 80c. per ton.

E. N.-R. Prices of Construction Materials

ASPHALT—Price per ton in packages (350-lb. bbls. or 425-lb. drums) and in bulk in carload lots, f.o.b. points listed:

	Package	Bulk
New York (*Texas*)	$23.00	$18.50
Boston (*Mexican*)	23.00	18.50
Chicago (*Texas*)	27.00	22.00
San Francisco, *f.o.b. refinery*, Oleum, Cal.	18.00	12.00
Dallas (*Texas*)	27.10	21.10
Seattle, "*D*" *grade, California, f.o.b. Richmond*	19.50	13.50
Denver (*California*)	24.00	.....
Minneapolis, *f.o.b. Twin Cities (Stanolind)*	27.60	21.60
St. Louis (*Mexican*)	27.00	24.00
Baltimore (*Standard Oil*) (*f.o.b. refinery*)	23.50	18.50
Montreal (*Imperial*)	27.00	22.50
Atlanta (*Mexican*)	23.40	19.40
Detroit (*Mexican*)	22.25	18.50
Cincinnati (*Kentucky Rock*)	.....	11.65
Maurer, N. J. (*Bermudez*)	30.00	.....
Maurer, N. J. (*Trinidad*)	23.00	.....
Philadelphia (*Mexican*)	20.00	18.00
Kansas City, Mo. (*Texas*)	27.30	22.30
Los Angeles ("*D*" *grade, California*)	*18.00	*12.00
Birmingham (*Mexican*)	27.00	21.00
New Orleans (*Mexican*)	20.00	17.00

* F.o.b. El Segundo Refinery. Drums used in New York.

NOTE—Barrels or drums are optional in most cities. About 6 bbls. to the ton, and from 4 to 5 drums; 200 to 300 gal. to the ton.

PAVING STONE—

New York (grade I)	5-in. granite, 30 blocks per sq.yd.	$147.00 per M.
San Francisco	Basalt block 4x7x8	70.00 per M.
Chicago	about 5x8x5 dressed	3.60 per sq.yd
	about 5x8x5 common	3.25 per sq.yd.
Boston	5-in. Granite	135.00 per M.
Atlanta	Granite	2.50 per sq.yd.
Detroit	5-in. Granite	3.00 per sq.yd.
Baltimore	Granite	2.85 per sq.yd.
Montreal	Granite	104.75 per M.
New Orleans	Granite, 4x8x4	2.75 per sq.yd.
Cincinnati	Granite	135.00 per M.
St. Louis	Granite, 4x8x4	1.65 per sq.yd.
Kansas City	Granite	3.15 per sq.yd.
Philadelphia	Granite	3.90@4.25 per sq.yd.
Minneapolis	Sandstone	2.74 per sq.yd.

FLAGGING—

New York	Bronx, 4 ft. wide	$0.24 per sq.ft.
	Manhattan, 4 ft. wide	.24 per sq.ft.
	Queens, 5 ft. wide	.26 per sq.ft.
	6x24-in. cross-walk	1.30 per lin.ft.

CURBING—*New York*: Bluestone per lin.ft., f.o.b. barge New York, 5x16 in., 88c.; *St. Louis*: Class "A" straight, delivered, 5x18 in., *85c.* per lin.ft.; roundings, *$1.35*. *Birmingham*: Limestone, 5x18-in., $1.05 per lin.ft.

WOOD BLOCK PAVING—

	Size of Block	Treatment	Per Sq.Yd.
New York	3	16	$2.40
New York	3½	16	2.70
Boston	3½	18	*2.40*
Chicago	4	16	2.25
Chicago	3½	16	2.10
St. Louis	3½	16	2.40
St. Louis	4	16	2.75
Seattle	4	16	Off market
Minneapolis	3½	16	*2.40*
Atlanta	3½	16	2.00
New Orleans	3	16	2.20
New Orleans	3½	16	2.30
New Orleans	4	16	2.40
Dallas	4	18	3.90
Baltimore	3½	16	None used
Montreal	4	16	4.50
Detroit	3	16	1.94
Detroit	4	16	.....
Cincinnati	3½	16	2.35
Kansas City	4	16	2.50
Philadelphia	4	16	None used

Construction Materials

SAND AND GRAVEL—Price for cargo or carload lots to contractor, f.o.b., per cu.yd.; is as follows:

	Gravel 1½ In. Nov. 4	Gravel 1½ In. One Year Ago	Gravel ¾ In. Nov. 4	Gravel ¾ In. One Year Ago	Sand Nov. 4	Sand One Year Ago
New York (*alongside dock*)	$1.75	$1.75	$1.75	$1.75	$1.00	$1.00
Denver	1.90	1.90	1.90	1.90	1.00	1.00
Chicago	1.85	1.50	1.85	1.50	1.65	1.40
St. Louis	1.45	1.45	1.65	1.45	.93	1.08
Seattle	1.50	1.50	1.50	1.50	1.50	1.50
Dallas	2.38	2.38	2.38	2.38	2.00	2.00
Minneapolis	1.65*	1.65*	1.65*	1.65*	1.25	1.25
Cincinnati	1.30†	1.40†	1.30†	1.40†	1.05†	1.35†
San Francisco	1.80	2.15	1.80	2.15	1.40	1.50
Boston	1.50†	1.50†	1.50†	1.50†	1.00†	1.00†
New Orleans	3.00	2.60	3.00	2.60	1.80	1.75
Los Angeles	1.95†	.85*†	1.95†	.85*†	1.70†	.50*†
Atlanta	1.90†	2.20†	1.90†	2.20†	1.60†	1.65†
Detroit	1.45†	2.00	1.35†	2.00	1.10†	1.50
Baltimore	1.40	1.40	1.60	1.60	.70*†	.70*†
Montreal	1.25†	1.25†	1.50†	1.25†	1.25†	1.25†
Birmingham	2.00	2.00	2.00	2.00	1.50	1.50
Philadelphia	2.10	2.10	2.10	2.10	1.50	1.50
Kansas City, Mo.	4.00‡	4.00‡	4.00‡	4.00‡	.66*†	.66*†

New York—Grits, $1.75 per cu.yd.; ready mixed $1.85.
* At pit † Per ton ‡ Joplin chats.

CRUSHED STONE—Price for cargo or carload lots, per cu.yd. f.o.b. cities as follows:

	1½ In. Nov. 4	1½ In. One Year Ago	¾ In. Nov. 4	¾ In. One Year Ago
New York	$1.84	$1.75	$1.94	$1.85
Chicago	1.70	1.72½	1.87½	1.87½
St. Louis	1.83*	1.93*	1.93*	1.93*
Dallas	2.40	2.40	2.83	2.83
San Francisco	1.70	2.15	1.70	2.15
Boston	1.60*	1.60*	1.60*	1.60*
Minneapolis	1.75	1.75	1.75	1.75
Kansas City	2.00	1.50	2.00	1.50
Denver	2.50	2.50	2.50	2.50
Seattle	3.00	3.00	3.00	3.00
Atlanta	2.50*	2.20*	2.50*	2.20*
Cincinnati	1.65*	1.90*	1.65*	1.90*
Los Angeles	2.10	1.00*	2.10*	1.00*
Detroit	1.85@2.00*	2.00*	1.85@2.00*	2.00*
Baltimore	2.50	2.50	2.55	2.55
Montreal	1.80*	1.80*	2.00*	1.90
Philadelphia	2.10	2.10	2.10	2.10
Pittsburgh	2.85	2.85	2.85	2.85
Cleveland	2.70*	3.25*	2.70*	3.25*
Birmingham	2.00	2.00	2.00	2.00

* Per ton.

CRUSHED SLAG—Price of crushed slag in carload lots, per net ton, at plant:

	1½-In.	¾-In.	Roofing	Sand
Youngstown District	$1.30	$1.40	$2.00	$1.30
Buffalo District	1.25	1.35	2.25	1.25
Birmingham, Ala.	.90	1.25	2.05	.80
Cleveland, Ohio	1.70*	1.70*	....	1.40*
Eastern Pa. and Northern N. J.	1.25	1.25	2.00	1.25
Western Pennsylvania	1.25	1.25	2.00	1.25
Toledo, Ohio	1.25	1.25	1.50	1.25

*Includes freight charge.

LIME—Warehouse prices:

	Hydrated, per Ton Finishing	Hydrated, per Ton Common	Lump, per Barrel Finishing	Lump, per Barrel Common
New York	$18.20	$11.00	$3.50*	$2.10@3.00*
Chicago	20.00	18.00	.....	1.50†
St. Louis	23.50	19.50	.....	2.03*
Boston	*18.50*	*12.00*	3.60*	2.90*
Dallas	*19.00*	.....	.....	*1.82*†
Cincinnati	16.80	11.90	.....	11.40‡
San Francisco	25.50	21.00	.....	1.60†
Minneapolis	25.50	21.00	.....	1.70†
Denver	24.00	.....	.....	2.70*
Detroit	15.25	11.25	.....	11.75‡
Seattle, *paper sacks*	24.00	.....	2.80†	.....
Los Angeles	*25.00*	*20.00*	3.50*	19.00‡
Baltimore	24.25	17.85	2.55†	.....
Montreal	.....	21.00	.....	10.00‡
Atlanta	*22.00*	13.00	.....	*1.50*†
New Orleans	24.00	15.00	2.50†	2.00*
Philadelphia	23.00	16.00	.....	.....
Kansas City	17.50	16.00	2.60†	2.25*
Birmingham	22.50	16.00	2.40†	1.85†

* Per 280-lb. bbl. (net). † Per 180-lb. (net). ‡ Per ton.

NATURAL CEMENT—Price to dealers per bbl. for 500 bbl. or over, exclusive of bags:

	Nov. 4	One Year Ago
Minneapolis (Rosendale)	$2.80	$2.80
Kansas City (Ft. Scott)	1.45	1.35
Cincinnati (Utica)	1.72	1.72
Boston (Rosendale)	2.65	2.75
St. Louis (Carney)	2.35	2.50
Birmingham (Magnolia) pozzolan cement	2.40	2.40

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots f.o.b. points listed *without bags*. Cash discount not deducted.

	Nov. 4	One Month Ago	One Year Ago
New York, del. by truck	$2.50@$2.60	$2.50@$2.60	$2.50@$2.60
New York, alongside dock to dealers	2.15	2.15	2.15
Jersey City	2.33	2.33	2.33
Boston	2.30	2.30	2.40
Chicago	2.10	2.10	2.10
Pittsburgh	2.09	2.09	2.09
Cleveland	2.29	2.29	2.29
Detroit	2.15	2.15	2.15
Indianapolis	2.29	2.29	2.29
Milwaukee	2.25	2.25	2.25
Duluth	2.09	2.09	2.09
Peoria	2.27	2.27	2.27
Cedar Rapids	2.34	2.34	2.34
Davenport	2.29	2.29	2.29
St. Louis	2.20	2.20	2.20
San Francisco	2.31	2.31	2.31
New Orleans	2.30	2.30	2.40
Minneapolis	2.32	2.32	2.32
Denver	2.85	2.85	2.84
Seattle	2.65	2.65	2.65
Dallas	2.05	2.05	2.05
Atlanta	2.35	2.35	2.25
Cincinnati	2.37	2.37	2.37
Los Angeles	2.20	2.36	2.52
Baltimore	2.50	2.50	2.50
Birmingham	2.40	2.40	2.40
Kansas City, Mo.	2.35	2.35	2.30
Montreal	1.15	1.15	1.80
Philadelphia	2.41	2.41	2.41
St. Paul	2.32	2.32	2.32
Toledo	2.20	2.20	2.20

NOTE—Bags 10c. each, 40c. per bbl.; 20c. each in Canada, 80c. per bbl.

Current mill-prices per barrel in carload lots, without bags, to contractors:

Buffington, Ind.	$1.85	Hudson, N. Y.	$1.95
Universal, Pa.	1.85	Leeds, Ala.	1.95
Steelton, Minn.	1.90	Hannibal, Mo.	1.85
Fordwick, Va.	2.05	Lehigh Valley District	1.90
Mitchell, Ind.	1.95	Wyandotte, Mich.	1.75
Iola, Kan.	1.85	Alpena, Mich.	2.05
Mason City, Ia.	1.90	Richard City, Tenn.	2.05
La Salle, Ill.	1.95	Kingsport, Tenn.	

E. N.-R. Prices of Construction Materials

TRIANGLE MESH—Price per 100 sq.ft. in carload lots:

PLAIN 4-INCH BY 4-INCH MESH

Style Number	Weight in Pounds per 100 sq.ft.	Pittsburgh Mill	Chicago District Mill	Warehouse: New York	St. Louis	Dallas	San Francisco
032	22	**$0.99**	$1.01	$1.39	$1.06	$1.13	$1.22
049	28	**1.26**	1.29	1.76	1.35	1.38	1.55
068	35	**1.54**	1.58	2.16	1.66	1.67	1.91
093	45	**1.98**	2.03	2.77	2.13	2.00	2.46
126	57	**2.45**	2.51	3.45	2.63	2.55	3.03
153	68	**2.92**	2.99	4.11	3.14	3.10	.....
180	78	**3.35**	3.43	5.70	3.60	3.47	.....
245	103	**4.43**	4.53	6.21	4.75	4.58	.....
287	119	**5.12**	5.24	7.19	5.50	5.26	6.35
336	138	**5.93**	6.07	8.35	6.37	6.11	.....
395	160	**6.88**	7.04	9.65	7.38	7.12	.....
PAVING							
036P	17	**$0.76**	$0.77	$1.06	$0.81	$0.76	.....
053P	24	**1.07**	1.09	1.50	1.14	1.07	.....
072P	31	**1.35**	1.38	1.90	1.45	1.39	.....
097P	40	**1.74**	1.78	2.45	1.87	1.90	.....
049R	24	**1.07**	1.09	.....	1.14	1.02	.....
067R	31	**1.35**	1.38	.....	1.45	1.39	.....
089R	40	**1.74**	1.78	.....	1.87	1.90	.....

In rolls, 48-, 52-, and 55-in. wide and in 150-, 200- and 300-ft. lengths. Galvanized is about 15% higher. Size of roll carried in New York warehouses, 48 in. wide x 150 ft. long, or 600 sq.ft.

EXPANDED METAL LATH—Prices in carload lots per 100 yd. for painted:

Weight in pounds	New York	Birmingham	Chicago	St Louis	San Francisco	Dallas
2.2	$17.00	$19.50	$17.50	**$17.50**	$19.00	$23.50
2.5	18.50	21.50	19.00	**19.00**	21.00	25.00
3.0	21.50	24.50	22.00	**22.00**	*24.00*	28.50
3.4	23.50	27.50	24.00	**24.00**	*26.00*	31.00

BARS, CONCRETE REINFORCING—Current quotations per 100 lb., in carload lots, f.o.b., except at New York and St. Louis warehouses:

ROLLED FROM BILLETS

Inches	Pittsburgh Mill	Birmingham Mill	Warehouse: New York	Chicago	St. Louis	Dallas	San Francisco
½ and larger	$2.00	$2.25	$3.24	$2.60	$3.15	$2.75	$2.95
⅝	2.10	2.35	3.34	2.70	3.25	2.85	3.05
¾	2.20	2.45	3.44	2.80	3.35	2.95	3.15
⅞	2.40	2.65	3.64	3.00	3.55	3.10	3.35
1	3.00	3.25	4.24	3.60	4.15	3.75	3.95

For standard classification of extras for size and cutting of steel bars, see bar card of July 15, 1923.

ROLLED FROM RAILS

	St. Louis	Dallas		St. Louis	Dallas
½ in and larger	$2.35	$2.48	⅝	$2.75	$2.88
¾	2.45	2.58	1	3.35	3.48
⅞	2.55	2.68		.....	.....

BRICK—Contractors price per 1,000 in cargo or carload lots is as follows:

	Common: Nov. 4	Common: One Month Ago	Common: One Year Ago	Paving Block: 3-inch*	Paving Block: 3½-inch*
New York (del.)	$20.40-22.40	$20.40-22.40	$17.50-18.50	$45.00	$51.00
New York (at dock)	17.00	17.00	14.50	.....	.....
Chicago	12.00	12.00	12.00	42.00	45.00
St. Louis, salmon (del.)	15.00	15.00	16.00	40.00	42.50
Denver, salmon	9@10	9@10	12.00	.....	.....
Dallas	14.10	14.10	11.10	35.00	.....
San Francisco	15.00	15.00	15.50	.....	.....
Los Angeles	10.00	10.06	11.50	(not used)	
Boston (del.)	19.00	19.00	17.50	45.00	50.00
Minneapolis (del.)	13.75	13.75	13.50	.....	.....
Kansas City	14.50	14.50	14.50	(no market)	
Seattle	15.00	15.00	15.00	.....	42.50
Cincinnati	15.50	15.50	17.00	40.00	45.00
Montreal	20.25	20.25	17.50	100.00†	.....
Detroit (del.)	14.00	14.00	16.00	38.40	41.50
Baltimore	18.00	18.00	18.00	40.00	45.00
Atlanta	**12.00**	10.50	10.50	40.00	.....
New Orleans	15.00	15.00	15.00	.....	**60.00**
Birmingham	14.50	14.50	12.50	40.00	45.00
Philadelphia	18.00	18.00	15@19	40.00	50.00
Pittsburgh (del.)	16.00	16.00	16.00	.....	.....
Cleveland	12@14	12@14	14.00	.....	.....

*For paving blocks 3x8½x4 and 3½x3½x4 respectively. †Imported.

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York: Nov. 4 on Trucks*†	New York: One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco†	Perth Amboy N. J., Factory*
4x12x12	*$0.1027*	$0.1027	$0.088	$0.105	$0.0685	$0.108	.....
6x12x12	*.1541*	.1541	.119	.....	.09	.156	.....
8x12x12	*.1926*	.1926	.165	.205	.126	.244	.....
10x12x12	.....	.....	.21	.....	.158	.....	$0.252
12x12x12	.....	.....	.233	.....	.188	.....	.312

*5 per cent off for cash. †Partition tile.

	4x12x12	8x12x12	12x12x12
Boston	$0.085	$0.175	*$0.28*
Minneapolis (f.o.b. cars)	.068	.1175	.205
Minneapolis (delivered)	.076	.13	.225
Cincinnati	.064	.1295	.1726
Kansas City	.088	*.164*	.242
Denver	.075	.155	.188
Seattle	.09	.18	.26
Los Angeles	.085	.172	.....
New Orleans	.13	.20	.35
Detroit	.0707	.1326	.1853
Montreal	.10	.....	.....
Baltimore	.124	.268	.....
Atlanta	.0895	.1837	.....
Dallas	.112	.19	.31
Birmingham	.11	.124	.....
Pittsburgh	.068	.128	.179
Cleveland	.062	.12	.....

STRUCTURAL MATERIAL—Following are base prices per 100 lb. in carload lots, f.o.b. mill, Pittsburgh and Birmingham, together with quotations in less-than-carload lots from warehouses at places named:

	Pittsburgh Mill	Birmingham	Warehouse: New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	$2.00	$2.05	$3.34	$4.15	$3.25	$3.10	$3.30
Channels, 3 to 15 in.	2.00	2.10	3.34	4.15	3.25	3.10	3.30
Angles, 3 to 16 in., ¼ in. thick	2.00	2.10	3.34	4.15	3.25	3.10	3.30
Tees, 3 in. and larger	2.00	2.10	3.34	4.15	3.35	3.10	3.30
Plates, ¼ in. thick and heavier	1.90	2.00	3.34	4.15	3.25	3.10	3.30

RIVETS—The following quotations are per 100 lb.:

STRUCTURAL

	Pittsburgh Mill	Warehouse: New York, Nov. 4	New York, One Yr. Ago	Chicago	St. Louis	San Francisco	Dallas
½ in.	$2.50@2.60	$4.20	$4.50	$3.50	$3.65	$5.00	$4.75
CONE HEAD BOILER							
½ in.	2.90	$4.40	$4.70	$3.70	$3.85	$5.20	$5.00
⅝ and ¾	3.05	4.55	4.85	3.80	4.20@4.45	5.35	5.15
⅞ and 1	3.30	4.80	5.10	4.05	4.60	5.60	5.50

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh Mill	Birmingham	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$2.65	$2.85	$3.05	$3.75	$4.00	$2.83	$4.95
Cut	**2.85**	2.90	.....	5.00	5.00	2.93	5.00

SHIP SPIKES—Current prices per 100 lb.:

In.	San Francisco: Galv.	San Francisco: Black	Seattle Black
½	$7.50	$5.75	$7.75
⅝	7.05	5.30	5.65
¾	6.90	5.15	5.50

Pittsburgh base in lots of 200 kegs or more, $3.25.

PREPARED ROOFINGS—Slate-surfaced roofing in rolls of 108 sq.ft. costs $2.31 per roll to contractors in carload lots f.o.b. New York.

Single shingles, slate finish, cost $6.49 per square (sufficient to cover 100 sq.ft.) in carload lots, f.o.b. New York. Strip shingles (4 in 1) f.o.b. New York, in carload lots to contractors, $5.09 per square.

ROOFING MATERIALS—Prices f.o.b. New York, to contractors in carload lots:

Tar felt (14 lb. per square of 100 sq.ft.) per ton	$72.80
Asphalt coating per bbl	17.00
Asphalt felt, per ton	74.20

WINDOW GLASS—United inches, 25, bracket size 6x8 to 10x15, single thickness "AA," 83 per cent; "A," 87 per cent; "B," 89 per cent. Double thickness "AA," 82 per cent; "A," 86 per cent; "B," 89 per cent discount from jobbers list at New York warehouses.

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

Blue Annealed	Pittsburgh Large Mill Lots	St. Louis	Chicago	San Francisco	New York
No. 10	$2.40	$3.60	$3.50	$3.90	$3.89
No. 12	2.45	3.65	3.55	3.95	3.94
No. 14	2.50	3.70	3.60	4.00	3.99
No. 16	2.60	3.80	3.70	4.10	4.09
Black					
Nos. 18 to 20	2.90	4.25	3.75	4.70	4.15
No. 22	3.05	4.40	3.90	4.85	4.30
No. 24	3.10	4.45	3.95	4.90	4.35
No. 26	3.20	4.55	4.05	5.00	4.45
No. 28	3.35	4.70	4.20	5.15	4.60
Galvanized					
No. 10	3.25	4.55	4.10	.....	4.40
Nos. 12 to 14	3.35	4.65	4.20	5.05	4.50
No. 16	3.45	4.75	4.30	5.15	4.60
No. 18	3.60	4.90	4.45	5.30	4.75
No. 20	3.75	5.05	4.60	5.45	4.90
No. 22	3.80	5.10	4.65	5.50	4.95
No. 24	3.95	5.25	4.80	5.65	5.10
No. 26	4.20	5.50	5.05	5.90	5.35
No. 28	4.45	5.75	5.30	6.15	5.60

For galvanized corrugated sheets add 15c., all gages.

LINSEED OIL—These prices are per 7½-lb. gallon:

	New York: Nov. 4	New York: One Year Ago	Chicago: Nov. 4	Chicago: One Year Ago
Raw in barrels (5 bbl. lots)	**$0.87**	**$1.00½**	*$0.85*	**$1.01**

E. N.-R. Prices of Construction Materials

WHITE AND RED LEAD—Per 100-lb. keg, base price f.o.b. New York:

	Dry		In Oil	
	Nov. 4	1 Yr. Ago	Nov. 4	1 Yr. Ago
Red	$15.25	$15.75	$16.75	$17.25
White	15.25	15.75	15.25	15.75

Lumber

Prices wholesale, per M. ft. b.m., to contractors in carload lots, f.o.b.

San Francisco—Prices of rough Douglas fir No. 1 common, in carload lots to contractors at yards.

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft.
3x3 and 4	$26.00	$27.00	$28.00	$31.00
3x6 and 8	26.00	27.00	28.00	31.00
4x4-6 and 8	26.00	27.00	28.00	31.00
3x10 and 12	26.00	27.00	28.00	31.00
3x14	30.00	30.00	32.00	34.00
4x10 and 12	26.00	27.00	28.00	31.00
4x14	30.00	30.00	32.00	34.00
	24 Ft. and Under		25 to 32 Ft.	33 to 40 Ft.
6x10	$28.00		$30.00	$32.00
6x14	34.00		36.00	38.00
8x10	28.00		30.00	32.00
8x14	34.00		36.00	38.00

New York and Chicago—Wholesale prices to dealers of long leaf yellow pine.

	New York		Chicago	
	20 Ft. and Under L.L.Y.P.	22-24 Ft. L.L.Y.P.	20 Ft. and Under No. 1 L.L.Y.P.	Up to 32 Ft. No. 1 Douglas Fir
3x4 to 8x8	$43.00	$44.00	$42.25	$40.50
3x10 to 10x10	50.00	51.00	*47.00*	40.50
3x12 to 12x12	57.00	58.00	*57.00*	40.50
3x14 to 14x14	65.00	66.00	....	40.50
3x16 to 16x16	77.00	78.00	....	42.00

New York—Wholesale price of long-leaf yellow pine timbers (rough) to dealers; to contractors, delivered from lighters or cars to job, $5@$10 additional. Short-leaf pine costs $3 per M. ft. less.

Over 24 ft.—Add $1 for each additional 2 ft. in length up to 32 ft. and $1 for each additional foot from 32 to 36 ft.

Other Cities

	8x8-In. x 20 Ft. and Under				12x12-In. 20 Ft. and Under	
	P.	Fir*	Hemlock	Spruce	P.	Fir*
Boston	*$49.00*	$48.00†	$50.00	*$51.00*	$60.00	$58.00†
Seattle	....	24.00	....	....	....	23.00
New Orleans	35.00	....	....	....	43.00	....
Baltimore	32.50	49.25	53.00	60.00	38.00	*49.25*
Cincinnati	37.00	73.00	73.00	85.00	48.00	77.00
Montreal	50.00	55.00	....	....	60.00	65.00
Los Angeles	....	33.00	....	....	....	33.00
Denver	....	36.25	34.75	34.75	....	34.75
Minneapolis	42.50	**38.75**	34.50	....	45.00	**38.75**
Atlanta	31.00	....	....	....	34.00	....
Dallas	56.00	....	....	....	56.00	....
Kansas City, Mo.	**42.50**	**42.75**	....	....	**57.50**	*42.75*
Birmingham	32.00	....	....	....	34.00	....
Philadelphia	54.00	38.00	38.00	45.00	65.00	38.00
Detroit	47.75	46.75	....	....	61.75	46.75
St. Louis	41.00	....	....	....	53.00	....

	1-In. Rough, 10 In. x 16 Ft. and Under			2-In. T. and Gr. 10 In. x 16 Ft.	
	P.	Fir*	Hemlock	P.	Fir*
Boston	*$45.00*	$42.00†	$45.00	$50.00	$48.00†
Seattle	....	22.00	....	....	24.00
New Orleans	72.50	....	....	45.00	....
Baltimore	55.00	44.00	44.00	34.00	50.00
Cincinnati	**70.00**	79.00	75.00	38.00	**85.00**
Montreal	45.00	50.00	40.00	65.00	50.00
Los Angeles	....	27.00	....	....	36.00
Denver	....	33.25	33.25	....	31.25
Minneapolis	42.50	36.25	34.75	36.00	34.25
Atlanta	22.00	....	....	28.00	....
Dallas	52.25	....	....	56.00	....
Kansas City, Mo.	*49.75*	*41.75*	....	*43.00*	*36.75*
Birmingham	27.00	....	....	**45@50**	....
Philadelphia	30.00	38.00	36.00	*35.00*	37.00
Detroit	39.75	37.00	....	46.50	41.25
St. Louis	43.00	....	....	29.00	....

Birmingham—Quotes carload lots, f.o.b. sidings; $4.00 additional per M. ft. to contractors.

Boston and Cincinnati—Prices to contractors in carload lots, f.o.b.

Denver—Quotes dealers price to contractors on large projects.

St. Louis—Wholesale price to contractors, f.o.b. cars, $3 per M.ft. additional.

Seattle—Price to contractors, delivered.

Dallas—Wholesale to contractors, $10 per M.ft. additional.

*Douglas fir. †Prime.

PILES—Prices per lineal foot, pine piles with bark on, f.o.b. New York:

Diameters	Points	Length	Barge	Rail
12 in. at butt	6 in.	30 to 50 ft.	$0.14½	$0.18½
12 in.—2 ft. from butt	6 in.	50 to 59 ft.	.19	.23½
12 in.—2 ft. from butt	6 in.	60 to 69 ft.	.21½	.25½
14 in.—2 ft. from butt	6 in.	50 to 69 ft.	.25½	.34
14 in.—2 ft. from butt	6 in.	70 to 79 ft.	.27½	.36½
14 in.—2 ft. from butt	5 in.	80 to 89 ft.	.35	.41

Miscellaneous

STEEL SHEETPILING—The following price is base per 100 lb. f.o.b. Pittsburgh, with a comparison of a month and a year ago:

Nov. 4	One Month Ago	One Year Ago
$2.25@$2.35	$2.25@$2.30	$2.25@$2.30

CONCRETE MASONRY UNITS—Standard 8x8x16-in., delivered to job, each:

Denver	$0.22	St. Louis	$0.18*
Detroit	.16	Boston	.22
New Orleans	**.25***	Minneapolis	.15*
New York (Brooklyn)	.18@.20	Philadelphia	.18@.20*
Pittsburgh	.18		

*F.o.b.

WIRE ROPE—Discounts from list price on regular grades of bright and galvanized are as follows:

	Eastern Territory New York and East of Missouri River
Plow steel round strand rope	35%
Special steel round strand rope	30%
Cast steel round strand rope	20%
Round strand iron and iron tiller	5%
Galvanized steel rigging and guy rope	7½%
Galvanized iron rigging and guy rope	+12½%

California, Oregon, Nevada and Washington: Discount 5 points less than discount for Eastern territory.

Wyoming, New Mexico and Colorado: Discount 5 points less than discount for Eastern territory.

Arisona: Discount 10 points less than discount for Eastern territory.

Montana, Idaho and Utah: Discount 10 points less than discount for Eastern territory.

North Dakota, Nebraska, Kansas, Oklahoma and Texas: Discount 5 points less than discount for Eastern territory.

MANILA ROPE—For rope smaller than ¾-in. the price is ½ to 2c. extra; while for quantities amounting to less than 600 ft., there is an extra charge of 1c. The number of feet per pound for the various sizes is as follows: ½-in., 8 ft.; ⅝-in., 6; ¾-in., 4½; 1-in., 3½; 1¼-in., 2 ft. 10 in.; 1½-in., 2 ft. 4 in. Following is price per pound for ½-in. and larger, in 1200-ft. coils:

Boston	$0.215	New Orleans	*$0.21*
New York	.23	Los Angeles	.25
Chicago	.22½	Seattle	.24
Minneapolis	.24½	St. Louis	.22½
San Francisco	.22	Montreal	.17
Atlanta	**.30**	Detroit	.24½
Denver	.24@.25	Baltimore	.18
Cincinnati	.21	Kansas City	.25
Dallas	.30	Birmingham	.26@.27
Philadelphia	.25		

EXPLOSIVES—Price per pound of dynamite in small lots:

	Gelatin 40%	Gelatin 60%
New York	$0.265*	$0.2875*
Boston	.23	.25
Kansas City	.22	.245
Seattle	.165	.19
Chicago	.195†	.2175†
Minneapolis	.1917	.2123
St. Louis	.22	.245
Denver	.2025	.2275
Dallas	.225	.306
Los Angeles	.1875	.2225
Atlanta	.23	.255
Baltimore	.22	.23
Cincinnati	.22	.245
Montreal	.1675	*.1893*
Birmingham	.22	.24
New Orleans	.233	.26
San Francisco	.1625	1925
Philadelphia	.215	.24

* Special gelatin in case lots. †Quantities above 500. lb. and less than a ton.

CHEMICALS—Water and sewage treatment chemicals, spot shipments in carload lots, f.o.b. works:

Sulphate of aluminum, in bags, per 100 lb.	$2.00@$2.10
Sulphate of copper, in bbl., per 100 lb.	*4.80@4.90*
Soda ash, 58%, in bags, per 100 lb.	1.38@1.55
Chlorine, liquid, tanks, per lb.	.04@.04½
Hypochlorite of lime (bleaching powder) in drums, per 100 lb.	2.00@2.10

FREIGHT RATES—On finished steel products in the Pittsburgh district, including plates, structural shapes, merchant steel, bars, pipe fittings, plain and galvanized wire nails, rivets, spikes, bolts, flat sheets (except planished), chains, etc., the following freight rates are effective in cents per 100 lb., in carloads of 36,000 lb.:

Atlanta	$0.58	Detroit	$0.29
Baltimore	.31	Kansas City	.735
Birmingham	.58	New Orleans	.67
Boston	.365	New York	.34
Buffalo	.265	Pacific Coast (all rail)	1.15*
Chicago	.34	Philadelphia	.32
Cincinnati	.29	St. Louis	.43
Cleveland	.19	St. Paul	.60
Denver	1.15*		

* Minimum carload, 50,000 lb., structural steel only; 80,000 lb., for other iron or steel products.